The society issuing

TRANSACTIONS

OF THE

AMERICAN CLIMATOLOGICAL ASSOCIATION.

FOR THE YEARS 1893 AND 1894.

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PRINTED FOR THE ASSOCIATION.
1895.

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CONTENTS.

LIST OF MEMBERS, 1894.

HONORARY MEMBER.

Stillé, Alfred, Philadelphia (1891).

ACTIVE MEMBERS.

Abbott, A. C., Univ. of Penna., Philadelphia.
Abbott, Griffith E., Bryn Mawr, Pa.
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Anders, J. M., 1603 Walnut Street, Philadelphia.
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Babcock, R. H., Venetian Building, Chicago.
Baker, Henry B., 726 Ottawa Street, Lansing, Mich.
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Bosworth, F. H., 26 West 46th Street, New York.
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Brannan, John W., 54 West 11th Street, New York.
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Daland, Judson, 319 South 18th Street, Philadelphia.
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GIHON, A. L., U. S. N., Washington, D. C.
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HALL, WILLIAM H., Saratoga.
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JACOBI, A., 110 West 34th Street, New York.
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McGahan, C. F., Aiken, S. C.
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Mays, Thomas J., 1829 Spruce Street, Philadelphia.
Mills, Charles K., 1909 Chestnut Street, Philadelphia.
Moore, H. B., Colorado Springs, Col.
Munro, John C., 367 Boylston Street, Boston.
Musser, John H., 1917 Chestnut Street, Philadelphia.
Mulhall, J. C., 2305 Pine Street, St. Louis.

Nunn, Richard J., 119 York Street, Savannah.

Orme, H. S., Box 1045, Los Angeles, Cal.
Otis, E. O., 93 Mt. Vernon Street, Boston.

Peale, A. C., U. S. Geological Survey, Washington.
Pepper, William, 1811 Spruce Street, Philadelphia.
Peterson, Frederick, 201 West 54th Street, New York.
Platt, Isaac Hull, Lakewood, N. J.
Platt, Walter, 165 Park Avenue, Baltimore.

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Reed, Boardman, Atlantic City.
Reed, Jacob, Colorado Springs, Col.
Rice, C. C., 115 East 18th Street, New York.
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Robinson, John A., 70 State Street, Chicago.
Robinson, W. D., 2112 Mt. Vernon Street, Philadelphia.
Roe, John O., 28 North Clinton Street, Rochester, N. Y.
Rogers, E. J. A., 222 Colfax Avenue, Denver, Col.
Ruck, Karl von, Asheville, N. C.
Ruedi, Karl, Denver, Col.

Schauffler, E. W., 1221 Washington Street, Kansas City.
Seiler, Carl, 1204 Walnut Street, Philadelphia.
Shurley, E. L., 25 Washington Avenue, Detroit, Mich.
Smith, A. Alexander, 40 West 47th Street, New York.
Smith, A. H., 22 East 42d Street, New York.
Smith, Frank F., St. Augustine, Fla.
Solly, S. E., Colorado Springs, Col.

Taylor, H. L., 590 Endicott Arcade, St. Paul, Minn.
Thomas, J. Carey, 228 Madison Avenue, Baltimore.

Trudeau, E. L., Saranac Lake, New York.
Tyndale, J. H., 48 East 3d Street, New York.

Walker, James B., 1617 Green Street, Philadelphia.
Ward, Samuel B., 135 North Pearl Street, Albany, N.Y.
Watson, E. W., 131 North 20th Street, Philadelphia.
Weber, Leonard, 25 West 46th Street, New York.
Williams, H. F., 450 Classon Avenue, Brooklyn.
Wilson, James C., 1437 Walnut Street, Philadelphia.

Total, 107 Members.

MINUTES—1893.

THE Tenth Annual Meeting of the American Climatological Association was held in the Hall of the College of Physicians of Philadelphia, May 25, 26, and 27, 1893. The President, Dr. Roland G. Curtin, of Philadelphia, occupied the chair throughout the various sessions. The address of welcome by the President and the accompanying papers and discussions contained in this volume occupied the four sessions.

At the Business Meeting, held at 3 P.M. on Friday the 26th, the minutes of the last meeting were read and approved.

The Treasurer's Report was presented, and Drs. Levick and Brannan were appointed an auditing committee, who subsequently reported the account correct and the balance in the treasury $311.29.

Dr. James J. Levick was nominated by Dr. Loomis a committee to prepare a short biographical sketch upon the services of deceased members, and proposed that such records be preserved by publication in the volume of Transactions. Agreed to.

The Council recommended the election of the following gentlemen to membership, all of whom were elected:

Dr. Robert H. Babcock, Chicago.
" A. C. Abbott, Philadelphia.
" Charles K. Mills, Philadelphia.
" Guy Hinsdale, Philadelphia.
" S. D. Risley, Philadelphia.
" L. D. Judd, Philadelphia.
" J. K. Weaver, Norristown, Pa.
" E. O. Shakespeare, Philadelphia.
" Landon Carter Gray, New York.
" I. H. Hance, Saranac Lake.
" Frederick Peterson, New York.

The Committee on Nominations, consisting of Drs. Bowditch, Loomis, Levick, Anders, and Otis, presented the following list of officers for 1894, who were unanimously elected:

President.—Dr. Andrew H. Smith, New York.

Vice-Presidents.—Dr. E. L. Trudeau, Saranac Lake, and Dr. Isaac Hull Platt, Lakewood.

Secretary and Treasurer.—Dr. J. B. Walker, Philadelphia.

Member of Council.—Dr. R. G. Curtin, Philadelphia.

A letter was read from Dr. Carmalt, Secretary of the Congress of American Physicians and Surgeons, announcing that it had been decided to place sections of the sessions of the next Congress under the charge of the individual associations comprising the same, taking them alphabetically; and that half of one of the afternoon sessions o the next meeting would be placed at the service of the Climatologists. On motion, the chair appointed Drs. Jacobi, Andrew H. Smith, and Bowditch, a committee to select a suitable subject and appoint referees.

On motion of Dr. Platt, a Standing Committee on Health Resorts was appointed in accordance with a suggestion in the President's Address. The following gentlemen were named thereon: Drs. Bowditch, Platt, Otis, F. F. Smith, and Fisk.

A letter was received from Dr. John A. Robinson, of Chicago, inviting the members of the American Climatological Association to the Congress on Medico-Climatology at the World's Fair in Chicago. Accepted.

The members were entertained at luncheon on Friday, at the Art Club, by the President, Dr. Curtin.

A dinner was given the Fellows of the Association by the Philadelphia members at the Bellevue, Friday evening; and at the invitation of Provost Pepper and Professor J. S. Billings a luncheon was enjoyed in the library building of the University, after which the Bureau of Hygiene was thrown open for inspection under the guidance of Dr. A. C. Abbott, Chief Demonstrator.

The President: Before we close the session Dr. Quimby would like to occupy your attention for a short time.

Dr. Quimby: When here in the spring, our President spoke to me in reference to some report of my results in the use of certain new preparations of ozone. I can give only a brief statement of their composition, with a few references to results from their use. This I am pleased to do, as I have been deeply impressed as to their value. There are four standard solutions:

Aquzon, a solution of ozone in an acidulated water containing from 5 to 6 per cent. per volume of ozone.

Therapol, containing 8 to 10 per cent. per volume of ozone in almond oil.

Kreozonol, 12 to 14 per cent. per volume of ozone in oil of tar.

Ærozol, 25 per cent. per volume in turpentine and some other oils.

The manufacturers also prepare an ozonized cod-liver oil, called *Kodozonol*, and an ozonized ointment of lanoline. I have the personal testimony of Prof. Witthaus that these preparations contain ozone in essentially the proportions given; that the aqueous solution is not decomposed under about thirty days; and that the others are permanent. My experience in their use confirms these statements. I have repeatedly seen a headache from gastric indigestion relieved within fifteen minutes by a small wineglassful of aquzon. I regard therapol as our most perfect local antiseptic. Since I first obtained this preparation I have practically used no other antiseptic dressing. No stronger proof of its value can be given than in saying that I have found vaginal tampons free from offensive odor when removed three days after application, although only a small external one had been saturated with therapol. Its action in acute catarrhal affections of the nose, pharynx, and larynx is immediate and most successful. I have seen, in my own children, the croupy element removed from the cough of laryngeal irritation within five minutes. Therapol is too heavy to be used in spray without high atmospheric pressures and a large tube. I have found it quite sufficient to apply it by a small swab of absorbent cotton. In diphtheria I regard it as almost a specific so far as the local process is concerned; and for the disease itself when used before systemic infection is fully developed. I have seen cases of nasal diphtheria, with the nose absolutely filled, entirely cleared of membrane, nasal respiration perfectly restored, and all discharge arrested within twelve hours after applications of therapol. A case of cancer of the breast I desire to report, but wish it distinctly understood that I draw no deductions.

Sometime since I removed a cancerous breast from a very fat woman, over seventy years of age. The wound healed by first intention, leaving a cicatrix over nine inches long. The report from Dr. Stearns, of the Loomis Laboratory, stated that at no point was the incision within less than an inch of cancerous tissue. At the end of eight months, however, the growth had returned to a degree demanding a second operation. This wound also healed without suppuration. After five months more a third operation was performed after consultation with Dr. McBurney. This wound healed with equal kindness, although longer than the previous ones, as the growth had extended deeply in the axilla. I desire to call attention to the fact that at the second and third operations the new growth was found not only in the cicatrix but at isolated points in the adjacent skin. Following this third amputation, which, so far as I can judge, was no more

thorough than in the previous operations, the cicatrix and surrounding tissues were rubbed twice daily with therapol. At an examination made *nine* months after the three operations the cicatrix was found soft, white, and non-adherent, with the exception of a single point where there was a small cancerous nodule the size of a pea. The adjacent skin, so far as could be determined, was perfectly healthy. I take the liberty of putting on record here my disbelief in the bacterial origin of cancer solely. I regard it as the result of a lowered cellular vitality. It was upon this basis that therapol was used to improve tissue vitality by a direct supply of active oxygen. At present I dare go no further than to hope that my belief is correct, and that this *post hoc* was also a *propter hoc*.

Kreozonol is simply a stronger and more stimulating preparation, to be used for foul, sloughing surfaces. My own line of work has afforded the most frequent occasion for the use of these preparations in dressing wounds after removal of tissue from the nasal cavities.

In a reasonably extensive experience I have yet to see an offensive discharge from such wounds, or any suggestion of systemic septic infection. It is my habit to cover such wounds with wads of cotton soaked in therapol, or kreozonol when there has been previous ulceration, and leave this dressing until it comes away of itself.

I am unable to speak with equal definiteness concerning the systemic effect of aquzon. Although numerous cases have given me a very decided belief that it does act systemically as well as locally, it is plain that such evidence contains more unknown and uncertain factors than that where the action is superficial. I am, however, convinced that aquzon should be given largely diluted when its systemic effect is sought. At present my experience includes only cases of gout, rheumatism, anæmia, and phthisis, with a single case of heart disease (aortic double murmur from syphilis). The testimony of this patient, however, a most intelligent lawyer, is that "nothing ever did him so much good as treatment with the pneumatic cabinet in connection with the persistent use of aquzon."

I have had no valuable experience with kodozonol, as its taste, as made at present, forbids its use in private practice. All these preparations may be obtained of the Ozone Manufacturing Company, 47 Liberty Street, New York. Their apparatus for the manufacture of ozone gas is most satisfactory when it is required in large quantities for hospitals or sanitaria. When desired for inhalation it may be made with a few cells of a battery, a Ruhmkorf coil, and a Siemens tube, by the methods described in any full work on chemistry.

For this purpose it should be made from pure dry oxygen. A modification of the Siemens tube, which I have had made, promises to

give even better results than the original. In this tube the tinfoil coating is applied to the *inner* side of the inclosing tube, in the same manner as in making a Leyden jar, and to the *outside* of the inner tube. By this arrangement the electric discharge from the coil passes through only the current of oxygen which is to be converted into ozone, and not through the two walls of the supporting tubes. This combination is probably not original with myself, although I have not found any description of such an ozone-generating tube. The common Siemens tubes may be obtained from any large manufacturer of chemical apparatus, or constructed by an expert glassblower. The tinfoil terminals of the original have been entirely dispensed with, and the connections made by filtering the inner with and immersing the whole generator in some good conducting fluid. A saturated solution of sulphate of copper makes a very satisfactory terminal.

I shall be most happy to give any further information in my possession to any gentleman who desires to employ this therapeutic agent which has been so long recognized as our most powerful antiseptic and stimulant to animal life, but has heretofore been obtained and retained with such difficulty.

Dr. Gihon: I have a motion I would like to make I desire to return the thanks of this body to our retiring President for the very able manner in which he has conducted this meeting; and express to him our personal gratification for those who come afar for the delightful success socially this has been; for the pains he has taken in entertaining, and his success in keeping so large a number of the Association here to the end. Seconded and carried unanimously.

J. B. Walker,
Secretary.

CLOSING REMARKS OF THE PRESIDENT.

GENTLEMEN OF THE AMERICAN CLIMATOLOGICAL ASSOCIATION:

This is one more kindness added to the great number that have been showered upon me by this Association, and I feel that I have not done as much as I wished to do.

It is a pleasure to know you appreciate the efforts of the Committee on Arrangements to make this meeting a success, for it has been a great success as regards good scientific work. I have never heard more valuable papers and discussions at any of the meetings. I have been present at every meeting since becoming a member.

It is especially gratifying to me that you have come to the front so kindly and assisted in making the Tenth Annual Meeting in Philadelphia a success.

With many thanks to the Committee of Arrangements, and to each and every one present, and with a hope that we may all meet again next year in Washington, I bid you an affectionate farewell.

PAPERS

READ AT THE

TENTH ANNUAL MEETING

OF THE

AMERICAN CLIMATOLOGICAL ASSOCIATION,

HELD IN THE HALL OF THE

COLLEGE OF PHYSICIANS,

Philadelphia,

MAY 25, 26, AND 27, 1893.

ADDRESS OF THE PRESIDENT.

By ROLAND G. CURTIN, M.D.,
PHILADELPHIA.

Gentlemen of the American Climatological Association: Through your kindness it is my great pleasure to deliver the tenth annual address, and to cordially welcome you to the metropolis of Pennsylvania, founded by the Quaker, William Penn, who is, I believe, the only man mentioned in the history of this country who, after treating with the savages, retained their confidence, respect, and good feeling. We, as his successors, are glad to welcome you to our Quaker meeting, and hope that "the spirit may move you" to say much on the subjects to be considered by our Society. We hope that you may be so treated during your sojourn with the broadbrims that you may go to your wigwams with a feeling akin to that of the red men who had dealings with the founder of Philadelphia.

Owing to the fact that some present may not know the entire scope of our organization, I will give you a brief synopsis of the subjects embraced by our roster: Climatology in all its phases; diseases of the chest, including those of the lungs and heart; epidemiology; bacteriology; balneology; mineral springs and mineral waters; hygiene and dietetics.

Many think we are a company of old fossils who meet together annually to look at musty statistics of the Weather Bureau. From the name, one old lady thought we were "climbers," a sort of Alpine club that became elevated by—climbing (not otherwise) when we met.

As this meeting closes our first decade, it may not be amiss

to give a brief description of what has been accomplished by our Society at the first nine meetings.

In May, 1884, the first meeting was held in Washington City. Dr. Loomis was elected President, but owing to his enforced absence Dr. F. I. Knight, of Boston, being the First Vice-President, occupied the chair and delivered the first Presidential Address. Dr. Westbrook, of Brooklyn, read the first paper, entitled "The Etiology of Pulmonary Phthisis." The Society had at the close of this meeting 42 members; we now have 107. At the founding of the Association some of the members had doubts as to the ultimate success of the scheme, but as the work has progressed all have been encouraged and gratified at the showing of the past ten years, until now our TRANSACTIONS are a valuable addition to the literature of climatology and the allied subjects, and we have in our reports as much that is valuable and progressive as any special society can show, much new and important material having been given to the profession. Climates have been studied, and their fitness for special diseases, so that now we can direct our patients with more certainty to places that will not only be beneficial, but also comfortable and attractive. A brief summary of the papers published by our Association will show how numerous and varied the subjects are that have been considered at the first ten meetings:

Pulmonary phthisis and diseases of the air-passages	60
Pneumonia and pleurisy	6
Asthma	4
Diseases of the heart	15
Epidemic diseases	18
Mineral springs and baths	12
Experiments as to the effects of air-pressure on diseases of the heart and lungs	9
Studies of special climates	62

Many papers on special subjects have been read which could not be easily compactly tabulated, bringing the number up to about two hundred and twenty. It should be remembered that a number of monographs have been read that have not been handed to the Secretary, or were omitted from our TRANSAC-

TIONS because they had been published elsewhere, and are consequently not included in the above list. In the early days of our Society there was an impression among our medical brethren that we were organized to "boom" individual health resorts without regard to their merits. But all such efforts, if any there were, received an early quietus.

After the first and second annual meetings we had to pay several hundred dollars for the publication of our TRANSACTIONS. The last two years we have had offers from more than one publisher to print them gratuitously after they have made use of them in prominent medical journals.

Our growth has been substantial, like that of a coral island in the tropical seas, which is built by unseen workers which live and die beneath the wave, but leave their life's work (their houses) behind them. Generations come and go, until finally the surface of the sea is reached—then their work is first manifest by a break or ripple. Floating driftwood and seaweed become entangled in the coral; the interstices are filled with débris of shells, sand, and gravel, and the island rises above the surface; birds and waves bring seeds, and vegetation appears on the surface. The island grows and becomes ready for man to discover, acquire, and inhabit.

When our Society made its bow to the public it produced a ripple in the medical world. Our dead members represent the homes of the protozoa that have died, and we build on their work as others will build on what we leave. Since the organization of our Society much has been added by willing hands, so that to-day it stands as one of the most important structures in medical science. Its proceedings are now observed and read by the medical men of the world. I feel assured that this organization has been the promulgator of information that has not only added to the length but also to the usefulness of human life, which is, I am sure, of incalculable value, and the great end of all medical science.

I would feel derelict should I not particularize the losses our ranks have sustained during the last two years. The deaths have been seven in number:

Prof. Bowditch, our first honorary member. A man beloved by all who knew him. A "grand old man."

Prof. Frank Donaldson, Sr., of Baltimore, a founder and the fourth President of the Association. Well do we remember his kindly face, his genial smile, and the manly grasp of his hand.

Dr. W. C. Van Bibber, also a founder and a citizen of Baltimore, was a constant attendant on our meetings and a contributor to our TRANSACTIONS. It can be said of him with truth, "He was beloved by all our members."

Dr. James R. Leaming, of New York City, was one of the original band who formed the American Climatological Association. It can be said of him that he was a *man* in every respect —kind, gentle, sympathetic, yet efficient; studious and scientific, yet practical.

Dr. W. H. Geddings, of Aiken, South Carolina, was present at the birth of our Society. He was a worthy man and a faithful member, as modest and shrinking as a woman. He has gone to reap his reward for good, honest, creditable, and conscientious work done in this world.

Dr. William D. Hodges, of Nahant, Massachusetts, who was elected in 1889, at the Boston meeting, but has not been in attendance since that time.

Dr. Stone, of Lakewood, New Jersey, died on April 5, 1894. He was elected at our last meeting.

These men will be greatly missed at home, and we shall miss their kind companionship as well as their valuable contributions.

As a member of the American Climatological Association I may be pardoned if I make some suggestions that may tend to make it still more useful.

1. Many of the most valuable discussions of papers have been lost to outside members of the profession because they were not reported at all or were so imperfectly reported as to be of little value. To avoid this difficulty I would suggest that we employ a competent stenographer permanently.

2. I think we should have a permanent Committee on Health

Resorts, who should collect important data and report the same to the Society each year. Their reports should embody information as to the elevation, meteorology, accommodations, and general healthfulness, these reports to be published annually in our TRANSACTIONS as a guide to the members and the profession generally.

3. A Committee on Mineral Springs should collect information as to the composition of the waters and their medicinal uses, so that they would become available for our patients; and there is, I am sure, a general feeling among our members favorable to the holding of meetings now and then in some locality made prominent by its well-known advantages. We could in this way personally study the place and its surroundings and its special adaptation to the cure of disease.

4. As an organization we should ever be ready to raise our united voice in all important national questions, such as a rigid national quarantine to bar out foreign epidemics by uniform rules applicable to all ports of the country, enforced by competent national officers. Legislation looking toward the preservation of our forests—the question forced upon us as a nation by the lessened rainfall caused by diminished atmospheric moisture, the drying up of our brooks and rivers, causing pollution; the inviting of cyclones and tornadoes, to say nothing of the robbing of our mountain scenery of its beauty, caused by the wanton destruction of trees. We might assist in guiding Congress to establish a national leper colony, which we greatly need at this time. Perhaps the question of annexation of the Hawaiian Islands may assist in the solution of this pressing need, as there is already a leper colony there.

5. I think we should have a plan to raise the standard of our membership. I would suggest that we have a limit to our list of members.

6. Owing to the value and increasing importance of bacteriology in epidemics and other diseases, I would suggest that the interest of well-known bacteriologists be enlisted, and that they be requested to join our ranks.

Some people think that the climate has but little influence

in disease; perhaps if such persons were to move into an unhealthy locality for a year we would expect a strong report upon the marked influence of climate. Or, let a person who has lived for a long time in an unhealthy district, and lost his health thereby, move to a place of undoubted healthfulness, and an immediate improvement would probably take place—he, too, would, I think, be converted.

Take, for instance, one single element of climate—sunlight; it is of real and positive benefit. The domestic animals understand this factor of climate better than we do. It has been suggested by a writer that the success of the "blue-glass craze" was in proportion to the amount of sunlight which penetrated the colored medium.

In conclusion, let me urge that renewed vigor be introduced into our body, that new subjects, new thoughts be freely discussed and disseminated to the profession at large. Much praise is to be given to the noble, faithful men who have given such constant and able aid in the past, and we should, I think, particularly remember with gratitude our genial, able, and efficient Secretary and Treasurer, Dr. J. B. Walker, who has so long and so satisfactorily filled his important position.

One of the great charms of the American Climatological Association is, I think, its entire freedom from anything like medical politics—each one striving to elevate the organization rather than seeking his own personal advancement.

I would again thank the members for their great kindness in electing me to the highest office in their gift, and I can say without equivocation that they have endeared themselves to me by their uniform courtesy since I have been a member.

In closing permit me, in the words of the immortal Rip Van Winkle, to "hope that you may live long and prosper," both as an Association and as individuals.

ANGINA PECTORIS AND MARKED ANGINOSE SYMPTOMS FOLLOWING HEAVY BLOWS AND CRUSHING INJURIES ON THE PRÆCORDIUM, AND CHRONIC INFLAMMATIONS OF THE LUNGS, PLEURA, AND PERICARDIUM.

By ROLAND G. CURTIN, M.D.,
PHILADELPHIA.

Twelve years ago a case of angina pectoris came under my observation, complicated by chronic inflammation of the left lung and pleura. Shortly afterward another case presented itself with a history of a severe injury to the chest-walls, which had occurred several years previously. Since that time I have studied some fifty cases of angina pectoris with well-marked symptoms, and have been impressed with the number of cases which give an antecedent history of traumatism or chronic inflammation of the lung and pleura, in more or less close proximity to the heart. The frequency of this disease during the past three or four years may be explained by the fact that a large number dated their symptoms to a previous attack of influenza, and this makes me feel quite confident that some cases were excited by chronic influenzal poisoning of the nerves involved in angina pectoris. This is my preface.

I will first give briefly the history of some of the most marked cases that bear upon this subject.

Case I.—In 1883, F. S., a clergyman of fifty years of age, called upon me complaining of paroxysms of pain just above

the apex of the heart, of a sharp, piercing character, and of prickling pain and numbness, radiating down his left arm to his elbow, and at the same time appearing under the lower angle of the left scapula. With these attacks there was great anxiety and fear of death. He had his first attack six months previously, and has had several since that time. A sore spot remained for several days after each paroxysm. He had attacks of vertigo with several of the seizures, in one of which he fell down unconscious. Upon examining his chest I found a depression of the chest-walls above the heart, at the third interspace. At this point there was dulness in front and behind, with diminished respiratory sounds. He gave a history of repeated attacks of pneumonia of the left side some years previous to the anginose symptoms. He found relief during the paroxysm from strong mustard plasters locally, and Hoffman's anodyne in one-drachm doses, largely diluted, and repeated every hour until relieved. A cotton jacket was placed over the left side of the chest, which seemed to reduce the number and severity of the painful attacks. He gradually recovered, and in a year was apparently well. For the past nine years he has been attending his duties, without any return of his former symptoms.

Case II.—W. D., forty-one years old, paper-pulp maker. In October, 1888, he called upon me, stating that he had always been well, with the exception of the attacks of pleurisy hereafter noted, until three years previous to that time; he was then attacked with paroxysms of pain just above the margin of the ribs on the left side; they shot upward to the front of the point of the left shoulder, and to the top of the left side of the sternum and apex of the lung. He had marked evidences of thickness of the left pleura over the whole side of the chest, the result of a previous inflammation. The whole side was diminished in size and dull on percussion, with here and there old friction sounds. He was having his attacks almost daily, and was rapidly losing flesh. With these attacks he had intense pain over the heart, with a sense of compression of the chest-wall; he had a feeling of despondency, and more or less fear of

death. Excessive or injudicious eating, change in the weather, fatigue, or coitus would bring on these attacks. After treatment was instituted he greatly improved, gained flesh, and the paroxysms became fewer in number and lesened in severity, finally disappearing. In addition to the treatment given in Case I., three grains of antipyrine were given four times a day with apparent immediate benefit. In 1891 (two and one-half years later) a member of his family came to me for a death-certificate, stating he had come home from work, had eaten heartily, and was seized with a pain like those previously complained of; he put his hand to his chest, and almost immediately expired. They informed me that latterly he had slight attacks of pain in his chest, but that these were promptly relieved by the medicines I had prescribed.

Case III.—Mrs. F., aged thirty years, one child. Four years ago she had evidences of latent chronic phthisis on the right side, and had seemingly recovered. She was left, however, with the physical signs of contraction and induration of the right apex and adhesions over the greater part of the right lung. She had been delivered of a child seven months before her visit to me. I found she had bubbling râles at the right apex and the other physical signs of breaking down, most marked near the mediastinum. She had recently been troubled with dyspnœa. Along with these signs and this symptom she had sharp pains, starting from the right nipple and going to the front of the point of the right shoulder and down to the ends of the fingers. The attacks were brought on by fatigue, derangement of the stomach, or loss of rest. When she had these attacks she was awfully depressed and became excessively frightened. Her hand remained numb long after the attacks had passed off. She left the city, and two months later her husband came to me and requested me to consult with her physician in the country. From the latter I gleaned the following history: The day before my visit she had a sudden discharge of pus from her mouth, amounting to at least a quart. I found the physical signs of a broncho-pleural fistula at the point where I had discovered the dulness two months before. From this time on she

never had any pain in the right side of her chest, arm, or hand. She died a few weeks later from exhaustion. The condition found on the right side was evidently the cause of the anginose symptoms.

CASE IV.—W. W., thirty-one years old. Had pleuro-pneumonia of the left side of the chest when quite young; seven years since had an attack of angina pectoris in which he fell unconscious. He had also a feeling that a cold lump, three to four inches square, was inside his left chest to the left of and on a line with his nipple. He has had seven attacks. He was greatly frightened at first, but now the attacks are of less severity.

Resonance is impaired over the upper part of the left side of the chest. Vesicular sound distant and feeble, otherwise unchanged. Pleuritic friction. No murmur or other evidence of organic disease of the heart.

He is now apparently quite well.

CASE V.—L. P. D., forty-six years old, male, American. Admitted to Presbyterian Hospital September 29, 1891; died October 29, 1891. Family history unknown.

Previous history. Had a slight attack of rheumatism at sixteen and again at twenty-five, the second attack being very severe, and has been subject to a subacute form since that time. Has had malaria twice, the last attack when he was twenty-one. Has been a contortionist and general athlete. Has been a hard drinker, not easily intoxicated, and has led a life of much exposure. Has had gonorrhea several times. He claims to have been able by muscular action to dislocate his heart one and a half inches upward and two inches sideways; also that he could in the same way dislocate his stomach up under the ribs; also that he was able to produce a complete dislocation of the right hip. (See autopsy.) Two and a half years ago he first noticed an anginoid pain over the region of the heart, which has gradually grown worse. Five weeks ago he commenced to have shortness of breath.

Status præsens. Chest broad and muscular; fossa not marked. Neck short. Chest emphysematous and with very

little expansion. Percussion note hyper-resonant anteriorly and posteriorly, more marked on the left side. Tactile fremitus decreased anteriorly, but normal posteriorly. Respiratory murmurs are rough anteriorly with harsh expiration. No râles. Heart sounds faint. Aortic second sound accentuated. Apex-beat beneath the sixth rib one-quarter inch to left of nipple line. Area of cardiac dulness begins about fourth rib and extends laterally from left border of sternum to the anterior axillary fold.

October 1, 1891. Some orthopnœa; temperature below 96° F.; temper irritable.

3*d*. Respirations rapid. Systolic sound of heart weak.

6*th*. Anginoid pains one inch above the nipple. Sense of tightness in the epigastrium and region of nipple, and choking sensation at top of sternum. Numbness extends down outside of both arms and the ulnar side of the forearms to the distribution of the ulnar nerve to the little and ring fingers. This combination exists only during his anginoid attacks.

9*th*. Spits up a quantity of bright-red blood (sometimes it is dark and stringy), not mixed with mucus.

11*th*. Feverish and still expectorating blood.

16*th*. Marked œdema of right leg.

17*th*. Urine shows albumin and narrow granular casts. Œdema of right leg extends to knee; severe pain in calf. Hæmoptysis persists. Bubbling and subcrepitant râles posteriorly, more marked on right side and with marked dulness. Has balanitis, causing much pain, and a few drops of pus escape from the meatus. Used a sound to-day (has strictures) and irrigated bladder with boric acid solution.

18*th*. Very restless at night (dyspnœa), but dozes at times. Is growing progressively weaker. Vomits. Says that pain over the heart has shifted to right side of the thorax in region of right nipple. Hæmoptysis continues severe, with considerable cough. Right leg still quite painful. Percussion dulness of left lung posteriorly extend from base to fourth rib. Tactile fremitus and vocal resonance increased, with numerous subcrepitant râles throughout.

19*th.* Increasing dyspnœa; extremely restless, with nausea and vomiting; hæmoptysis continues to grow more severe; some cyanosis (lips especially); heart sounds very faint; complains of pain in right side of chest (more than in left now) and a feeling of general soreness; the back is extremely tender; restless, wakeful, and irritable; subcrepitant râles in chest.

20*th.* Temperature hectic; marked ascites; general symptoms are all worse.

25*th.* General œdema of lower part of the body. Heart sounds very weak. Slight fever. Dulness in thorax increasing.

27*th.* Temperature falling, dulness increasing, cyanosis more marked; growing progressively weaker. Heart sounds extremely faint.

28*th.* Cyanosis still more marked; skin otherwise of an ashen color. Abdomen and legs much distended with fluid. Respirations rapid, shallow, and labored. Heart sounds faint. Hæmoptysis.

29*th.* Great œdema of prepuce; gurgling heard on palpating abdomen. Pulmonary dulness marked posteriorly and around under axillæ; some bubbling râles near apices. *Great orthopnœa.* Temperature has fallen below 96° F.; at 12 M. it was 95.2° F.

At 2.10 P.M., upon attempting to use the commode (for he was extremely obstinate) he was seized with an attack of extreme dyspnœa and weakness, culminating in immediate death. A few respiratory movements were noted after the heart sounds were inaudible. He sweat profusely before death, his skin being cold and clammy.

Autopsy. Held twenty-three hours after death. Body well nourished; post-mortem lividity slight. The skin and cellular tissue, especially of the calf of the leg, is much distended with fluid. Weight of body is about two hundred and twenty pounds. Penis healthy with the exception of a slight scar seen at the corona; prepuce much infiltrated. Belly distended. On opening the thorax, fat being excessive all over the body, a stream of straw-colored serum exuded from right pleural cavity; this amounted to about two quarts, and pressed the right lung back

into the posterior part of the thoracic cavity. The pleural adhesions were very dense at the right apex, the parietal and visceral pleuræ tearing away with the upper lobe of the right lung. In the left pleural cavity the adhesions were less dense and less numerous, being easily separated by the fingers.

On opening the pericardial sac it was found to contain bloody fluid, which probably came from a puncture into the right ventricle. The sac itself seemed normal, and the fluid was two or three times the normal quantity.

Lungs: The right was firmly flattened against the posterior wall and was about half the normal size, mostly from old adhesions. In the lower lobe at the posterior inferior border was a large hemorrhagic infarct, four by four inches. The base is turned toward the periphery and is about four inches in size, the apex being about five inches from the surface of the lung. Another infarct, about two by two inches, was located at the lower anterior border of the same lung. The contents of both infarcts were coagulated blood and connective tissue, and were quite compact and resisting to the finger. On dissecting from roots of lungs to apices of the two infarcts no distinct circumscribed thrombi were found, though the blood was clotted some distance back from each. The rest of the lung was but slightly crepitant. No deposit in apex.

Left lung: In lower lobe was found a hemorrhagic infarct of the same appearance and density as those in the right lung, though not so large. The organ was elsewhere crepitant. No deposit in apex. Slight hypostatic congestion existed at bases of both lungs.

Heart: Bovine, measuring seven inches from base to apex, and eight inches in width. It weighed eighteen ounces. The left ventricular wall was three-quarters of an inch thick, and the muscle was very firm. This cavity contained much currant-jelly clot. The left auricle was much distended and filled with recent clot. Walls of the same were stretched and very thin. The mitral leaflets were thickened, especially the anterior one, which was curled upon itself. The orifice was somewhat dilated, admitting three fingers to the second joint. The pos-

terior and middle aortic valves were somewhat thickened and atheromatous, while along their edges were recent inflammatory deposits. These were probably ulcerative in character and possibly accounted for the embolic processes in the lungs. The aorta itself was healthy. The right ventricle contained currant-jelly clot and the tricuspid orifice was dilated, admitting four fingers easily, but no deposits or curling were found. Muscle fibre firm, but only one-half of an inch thick. No valvular changes on the right side. Right auricle contained currant-jelly clot and the walls were stretched and the cavity distended. No excessive amount of fat about the heart.

Abdomen: Thick, fatty walls; considerable serum exuded.

Liver: Somewhat enlarged, weighing about four and a quarter pounds, and containing several small cysts on its surface. On section it was somewhat congested and of fatty and cirrhotic type of lesion. No gummata or infarcts in its substance and no amyloid change.

Gall-bladder: Normal in size and contained fluid bile which on pressure exuded into the duodenum. (Hence bile and cystic ducts patulous.) No gall-stones.

Stomach was dilated and showed evidences of chronic gastritis. Intestines were not opened.

Pancreas was of good size. Spleen normal.

Kidneys were both of the beginning chronic or subacute stage of parenchymatous nephritis plus the beginning of cirrhosis consequent upon the interstitial process. Several small cysts were found upon their surfaces. Capsules stripped and the pelves were the seat of fatty deposit. The cortex of each was somewhat thickened and the pyramids distended with blood. Both kidneys were much enlarged. Bladder normal. Slight prostatic enlargement.

Bone-marrow was normal.

Heads of both femora were removed. The ligamentum teres of the right side was thought to be a little lax as compared with the left. Otherwise the conformity of the joints was normal. Bones were very large.

The five cases in the preceding group seem to have had their

origin in chronic inflammatory conditions in the chest and outside of the pericardium.

CASE VI.—Was admitted to the Philadelphia Hospital. Great dyspnœa was the principal symptom. He also had a cough, and his chest was filled with bronchitic râles. His respirations were rapid, and his face was quite cyanotic. The veins of his extremities were distended. The heart was exceedingly weak, and was beating rapidly. The radial pulse could not be counted, and was weak and markedly irregular. The extremities were cold, but no œdema was present. The patient was placed semi-upright in bed. He had a severe pain over the heart and running into the left arm. He immediately fainted, his head dropping over to the left shoulder, and both hands falling to the bed. He had three hypodermatic injections (two of morphine and atropine, and one of half a drachm of ether), and amyl nitrite by inhalation. The pain he described as starting in the præcordial region, going to the point of the left scapula, then up the anterior wall of the chest to the left shoulder, and down the inner border to the elbow. He had a slight pain in the right shoulder at the same time. He said the pain felt as though the contents of the chest were being forcibly torn out; he declared he was going to die. His mind wandered, and later on he began to get relief. He would ask for his mother, as he was going to die. The first paroxysm was very severe; three others of less severity followed. After all the attacks he had numbness of the left arm.

He states that he had five attacks of a similar nature before his admission, but none so severe as the one he had just before admission. He had swelling of the feet once, following one of his first attacks. He has a distinct mitral systolic murmur.

One year later he returned to the hospital with severe dyspnœa and pain over the heart, running to the shoulder and left arm. He had marked fear of death. Heart was rapid and weak; "tumbling impulse." Nitrite of amyl and morphine hypodermatically were administered. He became easier, and was given digitalis, nitroglycerin, and whiskey. When the heart slowed a systolic murmur could be recognized. Two days

after admission, in the night, he became pained and restless. He was given a hypodermatic of morphine, and a little later he died suddenly in the attack.

Autopsy. Body of a fairly well developed man.

Thorax: Adhesions of the left pleura to the walls of the thorax. Lungs not examined. Pericardium found to be *tensely stretched over the heart within.* On opening the sac *the heart bulged out of the opening*, and the pericardium was found to be adherent to the heart in many places. Some adhesion was due to strong bands; again, in places, especially over the right auricle and upper part of the right ventricle, the adhesion of pericardium to heart wall was by agglutination. There were also on the surface of the heart a few patches of freshly-formed lymph.

Heart: Weight, nineteen ounces. Left side appeared somewhat congested. Tricuspid and pulmonary orifices fairly normal. Mitral valves were thickened and stiff, the orifice small and admitting only the first joint of the thumb. Aortic valves were hard and thick. Aorta showed no sign of atheromatous change. The walls of the coronary arteries were somewhat thick, but not markedly stiffened. The heart muscle itself was apparently well nourished and healthy.

Liver: Some adhesion of the capsule to the liver. Hepatic substance firm. Dark and light mottling, due to congestion of the hepatic veins.

Kidneys: Pig-backed. Congested.

This case showed, on autopsy, that the heart was compressed by the pericardium. Chronic pericarditis, with a tense and compressing pericardium, may have been the exciting cause of the marked and fatal angina pectoris.

In the following group I will give you the histories of cases in which old injuries seemed to be the factor in the production of angina pectoris.

Case VII.—J. H., aged forty-two years, police sergeant. Always well, strong, and hearty. His pulse had never varied under the greatest excitement while a soldier in the late war and in the exciting experiences of his position as policeman. I

saw him in his third attack. At the commencement of the second attack he was suddenly struck down and became unconscious, with dilated pupils, slow and stertorous respiration, and blue surface. He remained in this condition several hours, and only slowly recovered consciousness. His history was that some years previous to this attack he had fallen from a tree, striking with great force against a fence over the region of his heart. Two ribs were fractured. Some time after this, while quelling a fight in a bar-room, one of the belligerent men picked up a castor filled with bottles and struck him a heavy blow over the cardiac region. This injury was followed by a large and painful tumor, which slowly disappeared under treatment. The attacks later on became slighter and have entirely ceased. The attacks were brought on by the least excitement or exertion.

After six months' suffering he slowly recovered. He is now free from the anginose pains, and is pursuing his regular calling.

Case VIII.—J. D., admitted to the Philadelphia Hospital on February 9, 1889. Had pneumonia in 1881. Venereal history denied. Three weeks before admission he had a severe attack, in which he lost consciousness.

In 1881 he received a wound from an Indian arrow just over the heart. This was cauterized. He states that the left side of the chest became very much swollen from the effects of the wound, and the army surgeon said his rib was broken. In 1882 he had an attack of pleurisy of the left side with which he was confined to bed for three months. Had pneumonia of the left lung in 1881. After receiving the arrow wound he suffered from palpitation on taking horseback exercise. Frequently since he was hurt he has had sharp pains in his heart, shooting to the shoulder and down the left arm ; at times the pain runs down the leg or up the back of the neck to the head, and rarely down the right arm. The members affected become numb, especially the arms. During the attacks he feels as though he would die, though at times he has minor attacks of much milder degree of severity. During severe attacks he may faint, and at other times he merely has to sit down, in which position he

feels more comfortable than either standing or reclining; he sits with his hands on his knees. To his knowledge, he has never had a convulsion or bitten his tongue. Of late the attacks have occurred frequently. He was observed in two comparatively severe attacks. Nitrite of amyl was administered by inhalation before light could be brought. When the light arrived the patient's face was flushed and he was covered with beads of perspiration. No marked pupillary symptoms. Respiration very labored and interrupted. After the attack he trembled violently and complained of numbness in both arms. In the second attack the nitrite of amyl was not given until the light arrived, in order to exclude the nitrite as a cause of the flushing of the face. This time the face was not flushed, but was rather pale, and there was no perspiration. On giving the nitrite his face became flushed.

Case IX.—H. G., aged thirty-four years. He came to my office with symptoms which pointed to a true angina pectoris. The history given was that seven years before the commencement of these symptoms he was caught between a wagon wheel and a watering-trough. He fell, and the heavy wheel of the wagon passed over his chest, striking him at the left nipple. I found marked evidences of adhesion over the left base anteriorly. He was improved by treatment, and failed to return.

Case X.—R. G., aged sixty-five years. In the fall ot 1875 he was kicked by a mule below and outside of the left nipple. Two ribs were broken, and he was obliged to remain away from work for six weeks. The present disease began in 1885 (ten years later). He was on night duty in a sugar refinery, and his first attack occurred early one morning when returning home. He was suddenly struck with a sharp pain in his chest. He does not know whether the pain radiated or not, as he soon became dazed and finally unconscious. In falling he grasped a fence for support. He thought he was dying and had severe pressure in the region of the heart. After oscillating between the almshouse and the hospital he suddenly died in one of the attacks.

Case XI—Mrs. S., aged fifty years, seamstress. Had

marked angina symptoms, the pain going to and stopping at the right elbow. Ever since an injury received some time ago she has felt uncomfortable around the region of the heart. She received the injury by stepping on a chair, which tilted, her whole weight falling on a projection on the back of the chair, striking her over the cardiac region. It was supposed at the time that she had fractured a rib directly over the body of the heart.

CASE XII.—M. G., aged forty-five years, cook. Has been suffering for the last twelve or thirteen years with a pain in her chest, which followed an injury. She was carrying a wash-tub and fell upon it, striking her side at the interspace between the fifth and sixth ribs, just outside the nipple line. She spat up blood for about four hours. In 1889–90 she had an attack of influenza, and has had anginose symptoms up to the present time (1893). This case did not present the more exaggerated symptoms of angina pectoris, but they were sufficiently well marked to make a positive diagnosis. She had paroxysms of pain over her heart, with great solicitude as to her safety, and pain and numbness going down both arms to the ends of all her fingers. In one of these attacks she became so bewildered that she wandered about without knowledge of her movements.

The first group of cases (Cases I., II., III., IV., and V.) seemed to have had their origin in chronic inflammatory conditions, pleural and pulmonary, in the chest and outside of the pericardium. We have all seen, when making post-mortems after death from acute pleuro-pneumonia, quite a number of cases in which the inflammation had extended to the pericardium as a complication, without being suspected during life. In this group of cases only one opportunity was given for a post-mortem, but may not a complicating pericarditis have been present in some of these? The post-mortem in Case V. showed a healthy condition of the pericardium, and the only old adhesions found were in the right side of the chest.

In Case VI. the pericardium was found to be tensely stretched over the heart to such an extent as to compress the organ. The heart probably enlarged after the pericardium

was rendered indistensible by the strong adhesions, the result of an old pericarditis; hence the pressure on the organ.

The last group (Cases VII., VIII., IX., X., XI., XII.) were probably due to old traumatisms. These old injuries may have caused inflammation of the pericardial sac.

We all know that angina pectoris does not occur as a complication or an early sequel in pericarditis, pleurisy, pneumonia, phthisis or pulmonary abscess. Therefore, how shall we explain the origin of the angina pectoris in the cases before recorded? After looking over the ground I have formulated the following suggestions. It has occurred to me that it might be a result, in some cases at least, of chronic adhesions in the pericardium and in others of adhesions around and compressing the heart. Whether or not it is brought about by a change in the circulation, by compressing the bloodvessels and thus interfering with the nutrition of the heart, acting in the same manner as in contractive disease in the coronary arteries, my observations will not definitely settle.

Or, again, are these symptoms produced by the same cause interfering with the nutrition of the nerves, thereby disturbing their action?

Or, finally, could they be the result of simple irritation of the nerves by the congestions which are liable to occur in old adhesions? These congestions, we know, occur as a result of slight changes in temperature, fatigue, and other disturbances of the system. You will observe that nerve-tire, mental excitement, indigestion, coitus, prolonged exertion, and exposure to cold were among the exciting causes of the paroxysms. We have all seen cases where old adhesions in the pericardium have caused great irritability of the heart, teasing the organ and first producing great irritability, and finally hypertrophy. If the heart is enlarged from any cause, and the fibrous bands inside the pericardium, or the pericardium itself, is in a rigid state, the firm compression might result in interfering with the nutrition of the heart, as seemingly shown in Case V.

Some years ago I had a case of aneurism of the aorta, with

very marked and severe angina pectoris. The autopsy disclosed the fact that he had old pericardial adhesions which almost entirely obliterated the cavity between the heart and the pericardial sac, pressing upon the enlarged organ. It has occurred to me that the cases of disease of the heart and aorta which are associated with anginose symptoms might be a result of an accompanying chronic pericarditis. In view of the foregoing observations it may be well for us to be on the alert for evidences as to the condition of the lungs, pleura, and pericardium when holding autopsies on cases that, during life, had marked anginal pains. I have the notes of three such cases, and can recall others. That the cases here reported are not of the milder and nervous type is shown by the severity of the symptoms as well as by the mortality, cases having died in each group. You will observe that in Case V. anginose symptoms were present with no post-mortem evidence of any previous inflammation of the pericardium or left pleural cavity, but on the right side the lung was bound down with old pleural adhesions. Whether these adhesions were accidentally present or causative I cannot say. Case III. had the pains on the right side and arm from chronic pleuritis or an empyema of that side.

Prognosis. In mild cases with healthy digestive and excretory organs, and no signs of organic, cardiac, or aortic disease, and with freedom from arterial fibrosis, the prognosis is good, provided the patient receives and obeys proper directions. Your prognosis should be guarded where the symptoms are very severe, or where the patient is weak, old, intemperate, overworked, or greatly exposed to dampness and cold.

Treatment. *Prophylactic.* In most cases the continued use of nitroglycerin in doses of from $\frac{1}{100}$ to $\frac{1}{200}$ of a grain, frequently repeated, will relieve the symptoms. I think that the reason this remedy so often fails to do good is that it is not given frequently enough. It is perhaps not generally known that the effect of this medicine passes off in an hour or two, therefore requiring administration at short intervals. It is more effective in warding off paroxysms than as a curative

agent. Protecting the chest by added clothing, or by cotton, woollen, or flannel pads will often afford immediate relief from pain. In extreme cases the patient should be kept in bed, not only to rest the heart, but also to protect him from exposure, fatigue, excitement, etc. In any case the diet and drink should be restricted as to quantity and quality, and his work diminished so as not to be fatiguing; in fact, temperance in all things should be insisted on.

Palliative. For the paroxysm the treatment should be prompt. Hoffman's anodyne, asafœtida, and valerianate of zinc, and if the pulse is hard and the face pale, amyl nitrite can be given. In extreme cases inhalations of chloroform and ether, or morphine and atropine, hypodermatically may be administered. Locally may be used dry cups, turpentine stupes, turpentine sprinkled upon dry flannel, hot-water bag or ice bag (according to the effect upon the patient), mustard plasters; and if the attack is greatly prolonged, mustard pediluvium and a blister over the præcordial region.

Curative. The hypophosphites are a good curative treatment and should be administered for months. Arsenic in small doses (to avoid disturbing the digestion) has a beneficial effect upon the disease, probably owing not only to its alterative influence, but also to its blood-making properties. Cod-liver oil is often of great benefit where the stomach will bear it well and the patient is losing flesh. Iodide of iron is a good alterative in anæmic persons. The following medicines may be administered internally with prospect of a cure in simple cases: Nux vomica, zinc preparations, the bromides, quinine, followed later by electricity (constant current). Constitutional causes should be attended to, including syphilis, gout, and rheumatism; organic heart disease and Bright's disease should receive special attention. Phenacetine and antipyrine in very small doses will sometimes reduce the severity of the paroxysms or prevent them altogether. In one case one grain four times a day relieved the last faint lingering pains. It is quite important that the patient should avoid the drinking of large quantities of fluids, especially those that are cold; over-

eating, excessive fatigue, excitement, mental or sexual; loss of rest, use of tobacco, active exercise, depressing emotion, and loss of sleep. Women should rest during the menstrual period.

DISCUSSION.

Dr. Quimby: I happen to have had a case under observation for several years which seems to be in the line of the pathology referred to by the President, and may give additional proof in favor of angina being essentially a question largely of muscular nutrition, or, perhaps more exactly, of ratio between cardiac power and sudden demands for such power. The case was one, by Professor Loomis' diagnosis, of extensive pericardial adhesions following a suppuratory pericarditis during an attack of smallpox. When I first saw the patient she was about thirty years of age. She suffered no pain or distress so long as she remained perfectly quiet in bed, but any attempt at motion beyond that of the arms or limbs in bed was followed by cardiac pain proportionate to the effort. During five years I attended other members of the family at various times, seeing this patient only in a social way; I am very sure she had no medical attendance for over six years, and I have definite knowledge that she lived in this condition for some years previous to my knowledge of the case. I did not see her at the time of her death, but for some year or more previous she had begun to suffer from slight anginal attacks without evident cause. The difficulty in this case seems to have been clearly and purely mechanical. The adhesions offered little obstruction to a degree of heart-action sufficient to maintain the circulation under conditions of repose, but at once became limiting forces to the heart's motion when that was increased by even the most moderate muscular exertion.

Such cases are, of course, exceedingly rare as regards the specific pathological condition, but it illustrates in the extreme the effects of other and more common mechanical obstructions to cardiac motion.

Dr. Smith: It seems to me that a large proportion of the cases ot angina pectoris may be traced to the disproportion between the muscular power of the heart and the resistance which the heart has to overcome. This disproportion may be produced in either direction—by diminution of the muscular power of the heart, or by increase in the resistance to be overcome; and I can see how the power of the heart can be materially reduced by the pathological conditions referred to. An intense pericarditis cannot fail to affect more or less

the nutrition of the organ, and probably there is penetration of the pathological process from the pericardium to the myocardium.

As to altitude, I remember one very marked case, which had its origin at the altitude of El Paso, Texas (7000 feet). The patient was able to be comfortable as long as he moved around quietly, but any considerable muscular exertion immediately brought on an attack. It could be brought on by simply lifting on the hub of a wagon, as he demonstrated to me—which was very interesting, but I thought he paid a good deal for the demonstration.

Dr. Levick: I have nothing to say bearing directly on angina pectoris. Some years ago I read before this Society a paper on heart-failure, and, indirectly, its association with angina pectoris. In fact, I said that, so far as my observation went, angina pectoris appeared to be more prevalent in northern than in southern climates. I think others as well as myself must have noticed how very numerous have been the cases of death reported of angina pectoris this cold winter.

Dr. Weber: As to the climatic influence on angina pectoris, it seems to me that it is important to distinguish between true and pseudo-angina. When I think over the cases it has been my privilege to make observations of, people who have died with true angina pectoris, I found in all of them (three) that there was advanced disease of the coronary arteries during life, the so-called sclerosis. The factors which led to the production of the disease, leading to cardiac death, were severe gout, syphilis, or, in one case I think, the sclerosed condition was brought about by causes mentioned by the last speaker—cardiac over-exertion, brought about by athletic sports or severe mechanical work.

I think that looking for climatic influence, in cases of true angina pectoris depending upon either aneurism of the arch of the aorta or advanced disease of one of the coronary arteries, is out of the question. The best plan is the greatest care at home, proper diet, proper living, perhaps iodide of potassium, and in the attack the morphine injection, or, to decrease the arterial tension peripherally, nitroglycerin.

But there are quite a number of cases which present the picture of angina pectoris without being simply a condition of the heart, such as we meet in true cases of hysteria and in dilatation of the stomach, and in consequence of other intra-thoracic disease, that have perhaps led to a disturbance of the heart in one direction or another. There climatic change may be of great service. I have no particular experience with the influence of climate in that direction, but from analogous reasoning one would suppose that people of the latter variety, if they receive proper treatment for the underlying disease, would do well at moderate elevations, say 1200 to 1500 feet.

Dr. F. P. Henry: Since the subject of angina pectoris has been introduced I will take the opportunity of saying a few words. Dr.

Smith's explanation of the pathology of the attacks, that is, of their being due to a disproportion between the power of the heart and the resistance in the arteries, is undoubtedly correct so far as the spurious angina, the so-called angina vasomotoria, is concerned; but I do not believe it is applicable to attacks of genuine angina. The latter is invariably associated with lesions of the heart and neighboring vessels, especially the coronary arteries, while the former may occur in the absence of any demonstrable organic disease of either.

I have at present in one of my wards at the Philadelphia Hospital a case of genuine angina—Heberden's disease, as it was formerly called. The patient is a man about fifty years of age, who, up to the last six weeks, had daily paroxysms of angina of frightful intensity The pain began in the præcordial region, passed in a horizontal line to the left, then sharply upward at a right angle to the shoulder, and down to the left arm. The course pursued by the pain could be traced by the patient with the greatest accuracy. The pain was accompanied with severe tonic convulsions of both arms and of the extensor muscles of the back, the effect of the latter being to throw the patient into a state of opisthotonos. The pulse during the attacks was small and rapid. The patient invariably became unconscious at the height of the paroxysm.

Up to the period mentioned, about six weeks ago, these attacks were of daily occurrence, the maximum number in a single day being four. The average daily number of attacks was probably two.

The case is one of aortic stenosis and insufficiency, with great hypertrophy of the heart and typical "water-hammer pulse. The attacks were never induced by exertion, since the patient was constantly in bed; nor had mental emotion anything to do with their causation. A few days ago the man was greatly alarmed by the escape of a lunatic from a neighboring ward, and yet no attack of angina ensued. At the time of this fright there must have been an abnormal disproportion between the force of the heart and the calibre of the arteries.

About six weeks ago this patient was placed upon tincture of aconite (gtt. ij every four hours), and since then has been free from paroxysms.

Another point of distinction between the genuine and the spurious angina is the comparative rarity of the former. Eichhorst remarks upon this fact, and I can corroborate it. During about twenty years of service in large Philadelphia hospitals I have seen very few cases of genuine angina, and none so marked as the one to which I have referred.

Dr. Ruedi: I have not seen a single case of genuine angina pectoris in nineteen years' practice, and I had to do with the well-to-do people in whom it is more common than it is among hospital patients.

A COMPARISON OF THE WINTER HEALTH-RESORTS IN THE ALPS WITH SOME PLACES IN THE ROCKY MOUNTAINS OF COLORADO.

By CARL RUEDI, M.D.,
DENVER, COLORADO.

WHEN I chose this subject to lay before you I little expected to meet with such difficulties in getting the necessary material together in due time so as to work it well and to present you a condensed statement of the individual meteorological facts. I am almost sorry to speak to you to-day on this subject, as some of the reports from Switzerland which I wished to use have not arrived yet, and so I can hardly do full justice to the subject. It is a question of great importance to the whole of the United States, because the dreadful disease which is *par excellence* treated by climates has a strong footing all over our country, and if America is able to offer the same or even better advantages to the invalids it will not be necessary to send them abroad and to put an ocean between them and their kin.

In writing the title of this paper I used the word "comparison," but we must remember that we can only compare similar things, and just here the difficulty commences: the climate of a place consists of so many factors that we can hardly expect to find two places congruent; they will be similar in some respects but different in others, and this I found particularly true of the two places I know best, Denver and Davos. Both these places are at exactly the same altitude, but this is really the only point in which they resemble each other. Moreover,

not even the meteorological observations can be used individually—viz., mean barometrical pressure, mean temperature, mean humidity; and so I have taken into consideration, together with the meteorological observations, the general character of the country, the fauna, and the flora. To give you an example of this necessity, I will describe my experience in October, 1891, in Hygiene, which had been recommended to me as a winter health-resort. It lies about forty miles north of Denver and has an altitude of five thousand feet, so it is two hundred feet lower than Denver or Davos. When I left the house to look over the grounds, I first stepped into the orchard; the ripe apples and pears were tumbling off the trees; then the landlord took me through a chestnut grove, where the spiky fruits were ready to add their flavor to the dessert-table; and at the further end of the garden, close to the border of the field, I saw the lazy watermelons and the sugar-melons sunning their backs and only waiting to be plucked. The tomatoes were growing everywhere, and all the vegetables from the cabbage to the peppers. Can we compare this place with Davos, though nearly the same elevation, if we remember that in Davos no cherry-tree, or fruit-tree, can bring forth its savory product, and that even potatoes and barley attain a very doubtful success? This led me to look out for places in Colorado which have the same character, fauna and flora, as the principal health-resorts for winter in Europe, Davos and St. Moritz, and I was fully convinced that I would find something similar in the range of the Rocky Mountains, and now I do not hesitate to say that the eastern slope of the American "backbone" offers as good climatic conditions as the European resorts, or even better.

Remember the situation of Colorado for a minute: two thousand miles from the Atlantic and one thousand miles from the Pacific, no great sheet of water intervening except the lakes, which are regularly frozen over in winter-time. Colorado receives its moisture almost exclusively from the Pacific Ocean, and a look at the map shows distinctly under what conditions the moisture can reach Colorado. As long as the wind from the

southwest, west, or northwest has its usual velocity, the Sierras and the western slope of the Rocky Mountains will condense the moisture, and it is only when the wind blows so hard that it travels thirty to sixty miles an hour that Colorado gets the benefit of a real downpour, and it is always the case that Colorado has for a day or two strong and boisterous winds before a heavy rainfall or snow-storm sets in. At the same time we must remember that between the Sierras and the main branch of the Rocky Mountains the vast plains of Utah lie, which will, as soon as the velocity of the wind slackens, condense a great deal of the moisture in the air. Excuse this digression, but it will explain some of the facts which I wish to put before you later on.

For my observations during this winter I selected such places in Colorado as resembled Davos in regard to character, fauna, and flora; but in order to do this I had to seek much higher altitudes, and only at an elevation of seven or eight thousand feet did I find what I wanted. A difference of two thousand feet between Colorado and Switzerland is required to put invalids under the same conditions. With Davos I wish to compare Estes Park, which is six thousand nine hundred and forty feet higher, and about seventy miles north of Denver at the foot of Long's Peak. It is a plateau quite surrounded by gigantic mountains, and is about ten miles long and six miles wide, with no end of little side valleys with lovely trout streams. In order to make a comparison with a European place the "Lenzer Haide" might be mentioned, between Parpan and Lenz in the Canton des Grisons, as it is almost a perfect counterpiece to Estes Park, but only on a smaller scale. Craggy precipices form the border of the picture, surmounted by peaks mostly covered with snow, pine-trees scattered about on the slopes, sometimes isolated, then again in groups, and lower down in regular pine-woods all over the park; the banks of the Thomson are fringed with willows, birch, and mountain-ash. Oats, barley, and potatoes are grown in sheltered patches, and occasionally the farmers have good crops, but sometimes they have to use them as feeding material, because

the fruit has not ripened. Of wild flowers there is a great variety, and they show similarity to those of Davos. In the early spring you will find anemones in abundance, crocuses, lilies of the valley, and violets. Later on you have no end of meadow flowers, and also the cacti in several species show their lovely blossoms to the observing eye. Of ferns there are many varieties, and also of saxifraga and gentiana. The flora has been described by Mr. Chapin, of Boston. The animals show a similarity to those of Davos, too: the mountain-rabbit, the fox, the coyote (not known in Europe), now and again a deer and a bear; the mountain-sheep, under the protection of the law, still can be seen, but I am afraid only by privileged eyes, as I was not able to detect any of them, not even with the telescope.

The birds which winter in Estes Park are the crow, the magpie, and several specimens of woodpeckers; during the summer, however, we find anything from the gray humming-bird to the mountain-eagle, and I am happy to say that the meadow-lark and finches and other singing-birds are the constant companions of the solitary pedestrian. The purity of the air is so absolute that all objects, although some miles distant, show their details to perfection, and for an amateur in art or photography lovely studies are available. Gem Lake, Horse-Shoe Valley, Moraine, and South Park are places near by, that can only be compared with the finest idyllic scenery that Switzerland and the Tyrol can offer. By these remarks I have tried to show that these two places resemble each other except in altitude. Estes Park is one thousand feet higher than Davos. Does higher altitude in itself materially affect the human body under normal or abnormal conditions? is the question which forces itself at once to the foreground, and what are the effects of high altitude or lessened atmospheric pressure? This question has been so often ventilated already by the most eminent climatologists that one hardly needs to dwell upon it, and only facts *en masse* can ultimately decide this question; but I do wish to remind you that Quito and Santa Fé de Bogotá are very useful health-resorts at an altitude of twelve thousand feet, and particularly

useful for consumptive patients. I think that the diminished atmospheric pressure used in the cabinet gives us the proper explanation. In using the cabinet we put the patient for some hours in an altitude of five or seven to ten thousand feet, according to the barometrical pressure you wish to use, but we do not give him the other climatic factors of high altitude, and, therefore, the results are widely different. In a former publication I stated that the circulation and the nervous system are particularly influenced by high altitude, and this must necessarily be kept in mind; if the circulation is too poor to supply the organism with the necessary quantity of oxygen, or if the nervous system is so excited that insomnia sets in, then the patient had better go to a warm, equable seashore, but for patients with a fair amount of strength and resistance, the diminished atmospheric pressure has certainly only a beneficial effect, and the healing properties of the mountain air have been regarded by the medical profession ever since the time of Celsus as the most powerful remedy for consumption. Only some weeks ago, Dr. C. T. Williams, in his Lumleian lectures, showed with his own statistics the vast superiority of the mountain-air treatment in phthisis to any other treatment yet inaugurated. If we recall to mind the statements of Pasteur and Tyndall about the frequency of micro-organisms in the air, that with the elevation the number of germs in the air gets less, high altitude certainly can only be beneficial. We are not yet at the end of the bacteriological period, and can expect shortly to hear that fungi as well as the bacillus tuberculosis Kochii have a great deal to do with the destruction of lung-tissue, for a friend of mine, Mr. Cappin Jones, has published already an article describing a new fungus constantly present in cases of softening of lung-tissue, and which in pure cultures shows a decided tendency to affect the lungs.

That in different latitudes on our planet the character of the climate changes I do not need to mention, but it is worth mentioning that with each degree of latitude the difference is approximately three hundred and sixty-five feet in altitude to give

the country the same character and the same flora; so we have in Greenland the mountain climate at sea-level, and in Brazil at fourteen thousand feet.

To make the necessary observations, I asked two gentlemen friends of mine, to retire to the wilderness for the winter, Mr. Evers to Sunnyside, in Boulder County, at an elevation of eight thousand feet, and Mr. Killby to Estes Park, Larimer County, six thousand nine hundred and forty feet, and I have to thank them both for the unerring faithfulness they showed in taking the observations for me. The results of these observations I put against the official reports of the Swiss meteorological stations, but I am bound to say that St. Moritz has not answered my request, and has not sent in the tables up to date. The observations of the Sentis I have added to my list, because it is the highest point in Switzerland where official observations have been taken, and it gives us a fair comparison with the highest places in Colorado that are inhabited. The Sentis is an isolated peak nine thousand five hundred feet high, in the Canton Appenzell, near the eastern border of Switzerland; the observatory stands two thousand feet above timber-line.

The close study of these reports at hand led me to the following conclusions, which I shall try to prove with the aid of some condensed tables as extracted from the whole material—not to tire you too much with details—of which I may afterward make use.

I. The first point I wish to dwell upon is the barometrical pressure, and this shows in Colorado decidedly less variations. One can go through the tables of Denver, Estes Park, and Sunnyside for week after week with hardly any alteration; but if once a depression sets in, the difference of the readings can be nearly as marked as in Switzerland, but the averages of the different months show always less variations; and both my observers agreed in this point. If I give you the monthly averages for Estes Park for the months of December, 1892, and January, February, and March, 1893, you will see that the monthly range is almost *nil:* December, 1892, 22.06; January, 1893, 22.11; February, 22.01; March, 22.01.

II. Humidity is the second and one of the most striking points of difference we have in these two countries, and I wish to give you in a short table the means of the relative humidity per month as observed last winter with the hygrometer.

	Denver.	Estes Park.	Sunnyside.	Davos.	Sentis.
October . .	53		61	77	85
November .	45	40	62	79	76
December .	60	47	66	81	77
January . .	39	38	59	86	71
February . .	54	49	70	82	79
March . .	52	41	67		62

The maxima of the readings in Davos and on the Sentis show every month one hundred; the maxima in Colorado never reached saturation during this period. The reasons for this difference we have to seek in the amount of precipitation, and if I recall to your mind that in Colorado hardly anything grows unless the soil is under artificial irrigation, I only need to give you the items of the precipitation during winter, as during summer the power of evaporation is by far greater than the rainfall. Denver has a very minute record of the precipitation for the last ten years, and from this I can state that

			Inches of precipitation.
November, on an average of ten years, had		. .	0.577
December	"	" . .	0.870
January	"	" . .	0.706
February	"	" . .	0.563
March	"	" . .	1.080

The months of November, December, January, February, and March show for the ten years, 1882–1892, a total precipitation of 37.96 inchas, or 0.759 inch for each month. A comparison of the two Swiss observations and the two Colorado stations for the last winter shows the difference to be most decided.

	Days of precipitation.			
Denver had in	28 in 6	months	(October to April)	6.79″
Estes Park "	19 in 6	"	"	6.64″
Davos "	53 in 5	"	(October to March)	11.24″
Sentis "	103 in 6	"	(October to April)	30.52″

By this table we see not only that the absolute precipitation is considerably greater in the Swiss mountains, but also that the number of days on which precipitation occurs is much higher, and this leads me to the third point of difference.

III. The sunshine, which I think is of such vital importance that some tables ought to be given. For some other purposes I put into comparison the hours of sunshine that Denver and Davos had during the months of November and December, 1891, and January and February, 1892, and I reproduce them here in an abbreviated form. Of sunshine,

						Hours.
Davos	had in	November,	1891,	on an average	per day	2.97
Denver	"	"	"	"	"	7.20
Davos	"	December	"	"	"	2.99
Denver	"	"	"	"	"	6.30
Davos	"	January,	1892	"	"	2.70
Denver	"	"	"	"	"	6.60
Davos	"	February	"	"	"	2.77
Denver	"	"	"	"	"	7.10

The observations for the winter of 1892–93 are very similar, and I give you a short table, together with the possible sunshine for each place and for each month.

	Possible hours of sunshine.				Hours.
Davos had	7.74	in October,	1892;	on an average	. 3.20
Denver "	11.20	"	"	"	. 8.52
Davos "	6.26	in November	"	"	. 3.62
Denver "	10.00	"	"	"	. 7.63
Davos "	5.32	in December	"	"	. 3.36
Denver "	9.48	"	"	"	. 6.39
Davos "	5.90	in January,	1893,	"	. 3.21
Denver "	9.77	"	"	"	. 8.50
Davos "	6.65	in February	"	"	. 2.95
Denver "	10.07	"	"	"	. 8.21

If we consider these tables we must confess that there is a great difference, and, instead of speaking of the sunny South, I think it would be more appropriate to speak of the lofty sunny parks in the Rockies. It is not only that the European sky produces more precipitation and gives less sunshine, the cloudi-

ness which is proverbial for England extends over the Channel too, and the really fine and cloudless days are fewer in number in Switzerland than in Colorado; still the difference in this respect is not so great, for it stands at four to five. I wish to remind you that the heliographic observations are taken in the middle of the business town in Denver; and J. J. Gulligan, the observer, to whom I owe many thanks for his assistance in procuring material, tells me that, in consequence of smoke which fills the air, he loses in the morning and in the evening a good deal of time, as the sun-rays are not then strong enough to make an impression on the instrument, although he still sees the sun in the sky. In the mountains themselves this disadvantage will not be felt. I am fully aware, however, that the mountains themselves will take away some of the sunshine. Let us compare the possible sunshine of Estes Park and Davos for the few months the observations have been taken.

	Davos. Hours.	Estes Park. Hours.
December	165	264
January	182	268
February	186	267
March	(not received)	325

By this we see that the possible sunshine is far greater in Estes Park than in Davos, and that it surpasses St. Moritz, so that if we take in consideration that the clear days in Switzerland are fewer than in Colorado we can understand the great difference in this respect.

IV. The fourth point I wish to speak of is the temperature, but this, of course, cannot be materially different, as I compare places with the same fauna and flora, which involves more or less sameness of temperature; but one fact struck me very much in Estes Park which I will mention briefly. The thermometer gives readings which are almost ridiculously even; for weeks you read 20° to 30° F. at 7 A.M., 40° to 45° at 1 P.M., 25° to 30° at 9 P.M. The only variations take place when sharp continental winds set in, and then at once the temperature falls very low, stays low until the snow-

fall has set in, to rise again to the usual point after three days. During this winter there were two depressions every month, which lasted exactly three days each time, but Mr. Killby writes me that "there were only three days between the 15th of November and the 1st of April that invalids would have been obliged to stay in their houses." He did not mark a trace of rain during his stay at Estes Park, while in Davos on the 15th of December, 1892, there was a decided rainfall.

V. A point of difference which is very striking to the newcomer to Colorado is the increased electricity. This has been mentioned in various former publications, and a number of details have been recorded; I only wish to speak comparatively and give you my own experience in this question. As long as I lived in Davos I never received an electrical shock in shaking hands with a patient, while in Denver it is almost an everyday occurrence, and frequently when a little child runs quickly through a room to greet the doctor quite a perceptible shock, accompanied with the usual click of uniting antagonistic electricity, is felt and heard. It is so common that the children don't notice it. Whether the electricity in the air is highly increased or not I cannot say, because the observations in this direction are so scanty that no deductions can be drawn from them, and to my great regret I must say that even at the present time no observatory makes any systematic observations. I think that the reason of this greater quantity of electricity in Colorado can be explained in one of two ways: either the electric current in the soil is materially greater, or a current of electricity is more easily produced by friction in consequence of greater dryness of the air. The first is a hypothesis, the second is a fact, but I could quite easily understand that an electric centre lies in the north of the Rocky Mountains, as magnetic centres are known to exist in the north of America. At the same time we must remember that this mountain-chain contains great quantities of metals which are constantly in mutual contact, and which might increase the intensity of the current. Why have we not yet tried to make use of the electric current in the earth for technical purposes—a power which

probably surpasses everything hitherto known? This increased electricity, whether produced by the electric current in the soil or by friction, can in some cases be beneficial, in others obnoxious; but it stands to reason that all those cases that need an exciting stimulus to the nervous system could be benefited by it, while those that need a sedative influence had better remain in lower altitudes. I cannot understand why electricity has not been more studied climatologically, because the difficulties can be overcome, and there is no doubt that this factor is of equal importance with temperature and humidity. I only remind you of this one observation on Mount Loury near Paris: the bacteriologists there found that their cultures of germs and fungi did not grow during the time that the air was positively electric, but they grew well while the air was negatively electric.

VI. The sixth and last point of difference I have to speak of is the wind. Colorado enjoys the name of being a windy place, and so it is in many quarters. But, until now, Denver and Colorado Springs have been the only places regularly visited by invalids, and both of these lie, properly speaking, outside of the mountain range, Denver more so than Colorado Springs. Wherever the mountains go abruptly over into plains the wind is a necessary consequence, because the different altitude produces of itself a great difference in the temperature, and the local currents are to the greatest extent dependent on the temperature of the strata of the air; but this is no criterion for the real mountain places in the centre of the Rocky Mountains themselves. In these parks at an elevation of seven thousand feet the air does not get overheated, and if it should do so during the summer months it will certainly not do it during winter, and it is marvellous how still the atmosphere during winter is. As Mr. Killby writes me from Estes Park, "There is no relaxing or moist wind corresponding to the Föhn which prevails in Davos-Plaz; the prevailing winds are from the west and southwest, but not, as a rule, such as to prevent invalids from exercising in the open air; though at the time of sunset care must be taken not to

be out while the temperature is changing, yet the evenings can still be enjoyed and be profitable to the progress in health." Davos has decidedly less wind during the winter season than any other place used as a health-resort, but there is no question that it frequently suffers from want of wind, because the smoke which is produced by the hotels, bakeries, and pensions hovers over the valley to such an extent that, when standing above this sea of smoke, one feels sure of being able to find something better than this. This feeling has been prevalent for many years past, and the doctors tried to put a stop to this contamination, but still the place is increasing and the coal made cheaper by the introduction of a railroad, and nothing has been done to prevent the smoke from ruining the place. Therefore, and only because of this, St. Moritz and Arosa have such good prospects. I know quite well that some physicians say that smoke is no contra-indication to phthisis; but, if we look at the reports of the graveyards, where it is clearly shown that even the marble, the granite, and the limestone monuments are quickly destroyed by the sulphuric acid contained in the air from the use of coal as fuel, we can understand that a weak lung will feel it, too. Fresh pure air, as God gives it to us, free from all contamination, is the first requisite for the successful treatment of consumption.

In giving you a comparison between Swiss health-resorts and Colorado climates I intentionally abstained from speaking of any superiority; every physician to whom I address this essay will be able to find out for himself where to send his patients; and, to come to a conclusion, I would like to say that Colorado and probably also New Mexico and Arizona have in their mountains natural advantages and climatic conditions which equal or surpass the best European health-resorts of this character. But until now the best places in these States resembling Davos and St. Moritz have not been made use of. Denver resembles very closely the lake of Zurich, with the exception of the altitude and the dryness of the air; Colorado Springs resembles the valley of the Rhine at Ragatz and Mayenfeld, but is always dry and has also higher altitude; and, for the real

mountain health-resorts nearly equal to Davos and St. Moritz I would propose Estes Park, at an elevation of six thousand nine hundred and forty feet. There we stand just at the upper border of the trees that bear leaves, and find the same character of country, the same fauna and the same flora as in Davos; and, if anybody wishes to have a good holiday in air as pure as one can find it, this is the place.

In these parks one has the opportunity of choosing building sites: one corner of the valley is sheltered, the other is exposed, while on the plains everything is exposed. A careful study of the situations will give one guidance where to build, particularly the observation of wind and sunshine. Colorado is not yet what it ought to be, "The Sanatorium of the United States," but I fully believe that it has the stuff in itself gradually to merit this name. If a system of health-resorts is once established at different altitudes to suit each individual case, I do not think Colorado could be beaten: Denver or surroundings as starting-point, at an elevation of five thousand two hundred feet; Colorado Springs, at six thousand feet, as second station; Estes Park, at seven thousand feet, as mountain health-resort; and one place not yet taken in consideration, at an elevation of eight thousand feet, for people that have to prove that their lungs have been cured, and for others that are sent into the mountains to expand the chest and for mountaineering. I think that this would be the ideal of a health-resort; as soon as the doctor sees the patient fit for a higher altitude, one step forward is made, and so gradually, according to their strength, the altitude can be increased; on the other hand, the doctor can send a patient from higher altitudes lower down without changing anything materially except the altitude. This would be a health-resort not known before, and is yet only a hope. Let us hope that the development of Colorado will proceed in this direction as it does in all others, and I am convinced the number of the saved lives endangered by the common enemy tuberculosis will be greatly enlarged, particularly if the doctors of the United States get accustomed to send patients for climatic treatment in the earlier stages.

DISCUSSION.

Dr. Otis: I would like to ask one or two practical questions. I am much interested in Dr. Ruedi's paper, as I have visited both places. Estes Park three or four years ago—I do not know how it is now—possessed very inferior accommodations and very poor board, and the arrangements for obtaining provisions were very inadequate. One might infer from the paper that there are now good accommodations, but unless there has been a very great change that is not the case. I would like to ask how that is now.

Dr. Brannan: It is nearly ten years since I lived in Colorado. I know most of the conditions have changed greatly. Colorado Springs, where I lived, has more than doubled in population; and what they have gained in one respect they have lost in others, I judge. There is more smoke there, the ordinary concomitant of a rather large and thriving town; but there are some points there which are rather better than Denver, and that is the soil. It is very windy in Colorado along the border of the mountains where these resorts lie. The soil is sandy, and you do not run the risk of getting your feet wet. I have seen a heavy snowfall and disappear in a short time without leaving moisture on the ground. Another point: there is never any rain from September to April, or October to March. If we were to take the rain out of the climate here, especially that after a snow-storm, you can see how much it would be improved. I was there for four years and do not remember seeing it. It rains but little, and when it does it is of least trouble to invalids, in the early summer and perhaps autumn.

As to accommodations, they are of the best, and you would find very pleasant society. You will find good accommodations at Manitou Park as there are at Estes Park, and good society in the summer. I have been there occasionally in the winter to see a patient, and the accommodations and food are fair, and one can have a pleasant time; but still, as a rule, in the winter they are pretty severe, unless you go to the larger places, as Leadville or Salida, and there one can get along very well. I would not advise anyone to go there in the winter unless they understood it very well. I went there in the winter, walking in three feet of snow, but did not feel uncomfortable until after we got in the mountains; and if I had been as much of an invalid as my friends supposed, I should not have got out. We were kept there for three weeks. The air being dry, I suppose made a great difference.

Dr. Bowditch: I am very much interested in the Doctor's paper. I think it proper, perhaps, in this connection, to speak of the effect of altitudes *per se*. I have had patients in Colorado, and am impressed very much with the effect of its climate on consumptives.

I naturally feel the great importance of dryness in all good climates for consumptives. During the last two years I have been much impressed with the effect of the climate in Southwestern Texas, in the mountains near San Antonio, at about 1500 feet above the sea-level. I had five patients there, which is not a large enough number to give definite results, but from those five the results thus far have been most favorable.

One of the patients, a lady, has been there for two years, and for over a year has had no cough or expectoration, has gained flesh, weighs more than ever before, and is engaged to be married. The doctor writes most favorably of the other four.

One advantage in sending patients to Colorado is that it is a growing country and patients have the advantage of good society. As to Boerne, Texas, there are excellent boarding-houses and ranches outside of the town. I would be glad to know if others have had similar experience in this region.

Dr. Otis: I forgot to call the attention of the Society to a charming book on the scenery of Estes Park, by Mr. Chapin, entitled *Mountaineering in Colorado: The Peaks About Estes Park.* It also contains a list of the "Flora of the Park," by Mrs. George W. Thacher.

Dr. Ruedi: Dr. Otis asked about the accommodations at Estes Park. In the winter there are none whatever. I read the paper to call the attention of the profession to the place; and hope that in time we shall be able to found a sanatorium and have as good accommodations in Estes Park as the best health-resorts in Europe; and I think we are entitled to compete with any of the health-resorts of the world.

I am sorry that I could not report on all the lofty places of Colorado, but I could not get the observers. I could not get a good observer in Colorado Springs, and none at all at Manitou. If I could have had ten more I think the paper would have been more interesting.

The soil is nearly everywhere the same. We have nothing but sand pretty nearly all through, to the depth of three or four feet; therefore, as soon as the water falls on the ground it loses itself in the sand and finds its outlet in brooks or streams. I do not think Colorado Springs has any advantage in this respect over any other place. If anything, the sand is finer in Colorado Springs, and particularly on the main streets—there we find, on the whole, too much sand in the air. As soon as the wind blows between 11 A.M. and 4 P.M. we see great clouds of sand—I think even more so than in Denver. In the business parts of Denver it will be nearly the same, but on Capitol Hill and Mt. Clair, I think there is less dust than in Colorado Springs.

SEASONABLE INFLUENCES IN ERYSIPELAS, WITH STATISTICS.

By J. M. ANDERS, M.D.,
PHILADELPHIA.

The predisposing causes of erysipelas have not hitherto received that careful study which they would seem to deserve. Among recent writers there are a few who contend that age, sex, season of the year, etc., have little influence upon the affection. By most authors, however, the disease is stated to be more frequent in the female than in the male sex, and more frequent in the young than persons in the advanced period of life.

Osler states that erysipelas is particularly prevalent in the spring of the year. "This was very noticeable in the Philadelphia Hospital, in which the erysipelas wards were usually empty except in the spring and autumn months." Clinical observation has clearly demonstrated that the following classes of individuals are peculiarly liable to the affection: (*a*) those who have sustained injuries or abrasions, even though very slight; (*b*) persons who have undergone surgical operations; (*c*) women recently delivered; (*d*) persons suffering from chronic alcoholism and Bright's disease.

It is a well-known fact that in many persons there is an individual predisposition, the complaint occurring in them repeatedly. Institutions in which unhygienic conditions prevail, afford numerous cases as a rule. The object of the present researches, to which I desire to call the attention of this Association, was in the main to ascertain the influence of the seasons on the appearance of cases of erysipelas. And although

they brought to light many interesting facts relating to other predisposing factors in this disease, these latter must be the basis of a separate paper. The present analysis of 2012 cases, collected from various sources, though chiefly from the wards of different hospitals of Philadelphia, gives the following result, when computed month by month.

TABLE I.

	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
Blockley . . .	31	19	31	30	13	9	10	8	16	17	26	26
Blockley . . .	92	88	119	121	109	53	40	29	34	45	60	87
Pennsylvania Hospital	59	72	71	115	74	32	28	23	10	30	43	64
Presbyterian Hospital	1	5	5	7	6	3	1	3	1	1	1	1
Episcopal Hospital .	6	8	9	17	6	9	4	3	3	...	8	2
Johns Hopkins . .	1	2	2	4	1	...	...	...	1	2	1	2
German Hospital .	2	1	1	2	1	1	...	1	...	...	...	...
Private practice .	12	13	17	25	15	8	6	6	9	10	11	11
Total for each month	204	208	255	321	225	115	89	73	74	105	150	193

In this connection I desire to acknowledge my best thanks to those who have kindly assisted me in collecting the statistics obtained from the several institutions before named. To Dr. George H. Crabtree for collecting the cases from the records of Blockley Hospital, to Dr. M. B. Miller for the cases obtained from the Pennsylvania Hospital, to Dr. J. S. Bromley for those furnished from the Episcopal Hospital, to Dr. Wiser for furnishing the cases from the Presbyterian Hospital, to Dr. William Osler for those from Johns Hopkins, to R. L. Pitfield for those from the German Hospital, and to the many professional friends who supplied cases from private practice.

A glance at the foregoing table will show that, considering the total number of attacks for each month, August gives the fewest cases, and that from month to month the number of cases increases in slightly varying ratio until we reach April,

which gives the maximum number; then there follows a rapid decrease until we arrive at the starting point or August. Again, a little computation will show that one-half of all cases occur during the months of February, March, April, and May, and 15.9 per cent. of all cases during the month of April alone. It would appear that the winter and spring months, though more particularly the latter, influence the susceptibility to the complaint. The minimum number of attacks are seen to occur in summer and autumn.

The subjoined Table (No. II) represents all the data for twenty years, namely 1871–90 inclusive. Tracing (*a*) represents 1163 cases of erysipelas. It will be observed that this tracing corresponds very closely to the number of attacks expressed in figures, contained in the general Table (No. I). Since 847 of the cases found in the latter table occurred either before 1871 or subsequent to 1890, they were eliminated from Table No. II. I have deemed it needless to give a tracing showing the totality of cases (2012), since it was found to be identical in almost every particular with that representing the 1163 separate attacks. Thus the influence of season upon the appearance of this disease is definitely established. This table also shows the mean barometer (tracing *b*), and the mean relative humidity (tracing *c*), for the same period for Philadelphia, to which further reference will be made presently.[1] It might be argued that since the statistics were taken chiefly from hospital records they did not indicate the actual effect of season on this disease. It will, however, be observed on referring to Table No. III, that the cases collected from private practice give strikingly similar monthly and seasonal variations to those indicated by the hospital statistics.

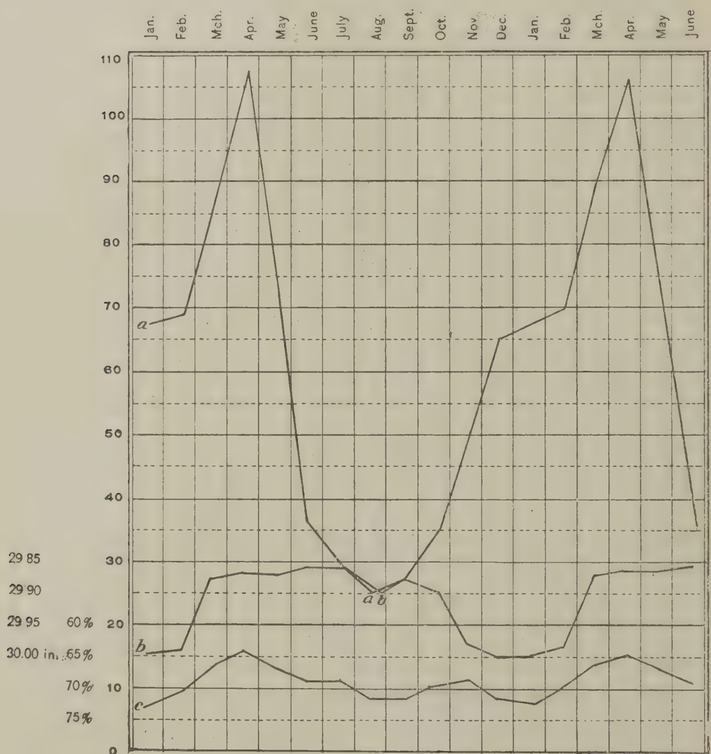
The statistics obtained from the Pennsylvania Hospital, 621 in number, show September to furnish the minimum number of cases (10). The months from October to April show on the whole a steady increase, and a rapid decrease from April

[1] My best thanks are due to Mr. Dey, signal service officer, for the courtesy he extended in allowing me access to the records of his office.

to September. Of the 621 cases 116 occurred in April or 18.7 per cent. The same ratio in favor of April obtains for the cases collected from the various other institutions.

The tracings in Table III represent: (*a*) 143 cases from private practice; (*b*) 621 cases from Pennsylvania Hospital;

TABLE II.

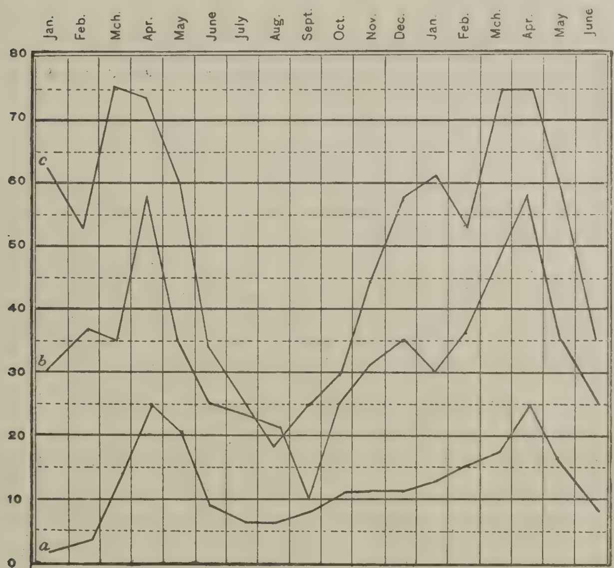


a. 1163 cases occurring from 1870 to 1890 inclusive.
b. mean barometer " " " " "
c. " relative humidity from 1870 to 1890, inclusive.
The cases increase in increments of 10.
Barometer is reckoned in inches.
Mean relative humidity is given in percentages.

and (*c*) 1113 cases from the records of old Blockley. It will be seen that the general character of the tracings bear a strong resemblance to one another.

In many instances the month of onset could not be readily determined, and sometimes the date of admission into the

TABLE III.



NO. OF CASES.

143	(*a*) Increase in increments of 10.		Private practice.
621	(*b*) " " " " 20.		Pennsylvania Hospital.
1113	(*c*) " " " " 20.		Philadelphia (Blockley) Hospital.

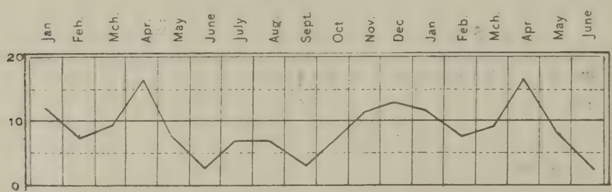
hospital was, from necessity, considered to be the month of onset. In the instances of traumatic erysipelas embodied in these statistics, the date of onset of individual attacks could be accurately determined.[1]

Of the 2010 cases only 101 have been recorded as purely

[1] In this connection it should be pointed out that all cases herein reported are classified in accordance with their time of onset.

surgical ones. The tracing in Table IV (*infra*) represents the traumatic cases, and shows in a general way the character of tracing (*a*) found in Table No. II, though a few deviations from what may be regarded as the normal type of this affection may be noted. Thus June marks the lowest point (2 cases), April the highest, as is usual; but the increase for April is not as pronounced as when the idiopathic cases are included. The number of attacks for each month of the year was as follows: January, 11; February, 8; March, 9; April, 16; May, 8; June, 2; July, 6; August, 6; September, 4; October, 6; November, 11; December, 13; total, 101.

TABLE IV.



101 cases of traumatic erysipelas. (Increase by tens.)

These surgical forms usually occurred in small groups, thus showing endemic influence.

The causes of the seasonal variations, and more particularly of the signal April increase, manifested in the prevalence of this disease have not as yet been definitely determined. Dr. Morris J. Lewis in a paper on "The Seasonal Relations of Chorea and Rheumatism, Extending over a Period of Fifteen Years, 1876–90 Inclusive," calls attention to the important practical fact that there is a spring augmentation of disease in general. He continues: "In my own practice, which is a general one, I find that the most visits are paid in March, namely 15.3 per cent., and from that point the percentage of visits falls to midsummer (absence of patients from city largely influences this fall); then gradually rises to January, 13.3 per cent.; falls in February to 10.5 per cent.; and rises to its highest point in March.

"This varying percentage I find is about the same as regards the practice of other physicians whom I have interrogated concerning this point, and might be considered by some as a sufficient cause to explain the March rise in the Philadelphia chorea tracings, upon the theory that March is the month when most disease occurs, but might I not pertinently ask the question, 'What causes this March rise in disease?'"

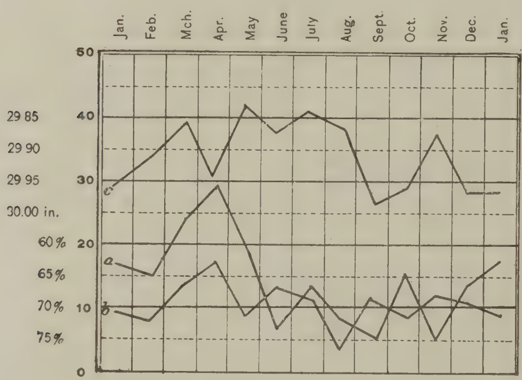
Reasoning from analogy, the increased prevalence of erysipelas in the spring of each year, more especially in April, cannot be accounted for by the general enrichment of illness at this season, since the greatest proportion of cases, and therefore the summit of the curved line occurs in April instead of March. We are obliged, therefore, to seek for other causal factors if we would be enabled to explain the greater spread of the affection throughout the winter and spring months than autumn and summer.

The relationship existing between the barometric pressure and the relative humidity and the appearance of this complaint, I have also endeavored to ascertain. In Table No. II the mean relative humidity and mean barometer have been represented by tracings *b* and *c*. It will be recalled that the observations extended over a period of twenty years (1871–90 inclusive); and these may be compared with tracing *a*. It may be seen that coincident with the increase of separate attacks during February, March and April there is a fall in the mean barometer and relative humidity. In summer, when the minima of cases appear, the mean barometer continues to be low, while the relative humidity increases steadily, reaching its highest point in August, the month giving us the fewest attacks.

Throughout the rest of the year neither the mean barometer nor the mean humidity tracings exhibit a constant or definite causal ratio to the erysipelas tracings. For example, the mean relative humidity during November and December gradually augments, corresponding with an increase in the percentage of attacks. A moment's reflection, however, will convince any thoughtful mind that the influence of individual climatic factors,

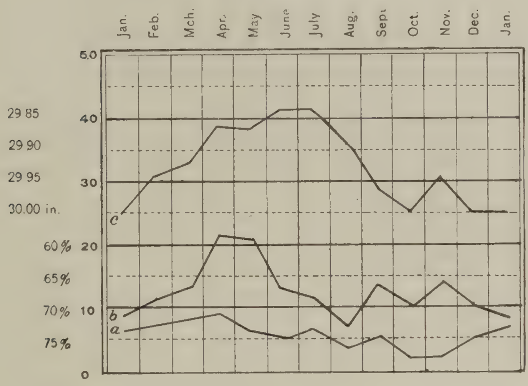
as well as any sudden, great, temporary, meteorological disturbances would be lost by a study of the mean barometer and the mean degree of saturation of the air extending over so long a period as twenty years. To obviate, so far as possible, this source of error I have selected the years 1885–86, which showed the largest number of cases for the period of two years, and these were studied together with reference to the points at issue; also two years (1871–72), which showed the fewest attacks. (See Tables V and VI.)

Table V.



Tracing *a*, in Table V, which characterizes the relative frequency of 170 separate cases (for the years 1885–86) exhibits the same proportionate increase in the number of cases for April as observed in Table II. The mean barometer during the April rise of the erysipelas tracing was low; but, as in the former instance, there is no resemblance between these two lines throughout June, July and August. The tracing indicating the mean relative humidity for 1885–86 bears very nearly the same relationship to the erysipelas tracing for the spring and summer months as shown in Table III, except that the decrease in the degree of saturation is not quite so well marked in the month of April. Here, again, for the rest of the year there is lack of harmony between the various tracings.

TABLE VI.



(*a*) Erysipelas tracing.
(*b*) Relative humidity tracing.
(*c*) Barometer.

Table VI represents the smallest number of attacks for two years (1871–72; and the tracings have in every leading particular the same form as those noted in Table V.

Surely the mean relative humidity tracings in all my investigations rise and fall with the erysipelas tracing during the first six months of the year. In other words, the number of cases of this complaint increases as the relative humidity diminishes.[1]

Again, the uniform results of these investigations into the mean annual barometer are as follows: The barometric pressure becomes lower during the winter and spring augmentation of attacks, maintaining this low standard throughout May, June, July and August, whilst during the latter months the cases steadily decline. Storm tracings have not been attempted. Erysipelas belongs to the acute infectious diseases, hence it was thought to be highly improbable that a study of the effect of storms upon this disease would throw any new light upon its etiology.

I have also studied carefully the temperature range for the

[1] It must ever be recollected that the reading of the barometer and relative humidity tracings are reversed as compared with the erysipelas line.

period of years embraced in the present discussion, and although this is an important climatic component, no data have been obtained that would tend to establish a relationship with the disease under consideration. Corresponding with the increase in the number of attacks, or the rise in the erysipelas tracing during January, February, March, and April, there is a steady rise in the mean temperature. On the other hand, the erysipelas line rapidly declines from April to July, while the mean temperature during the latter period continues to rise steadily. During the autumn, whilst the temperature is regularly declining, there is a constantly increasing prevalence of the affection. On comparing the temperature record with the mean barometer and mean relative humidity, we find that their several forms do not accord with one another, except during the first four months of the year. Hence the temperature chart, as a whole, offers no satisfactory explanation of the peculiarities that characterize the appearance of this disease.

Dr. Morris Booth Miller, while engaged in collecting the data from the Pennsylvania Hospital, made the interesting observation that many cases of erysipelas admitted into that institution occurred among sailors while at sea. At first sight it might appear that the explanation of their frequent occurrence under these circumstances might be found in some peculiarities presented by sea air. It is true that the marine climate has a more variable and, on the whole, a lower temperature than the climate some distance from the sea; but these facts, in the light of our researches, fail to furnish even a plausible interpretation of the observation noted by Dr. Miller. On the other hand, it must not be forgotten that the sanitary conditions of ships are often most unfavorable.

It should be noted that in 1885–86, the two years which gave us the larger number of cases, the mean temperature was a little higher for the months of January, February, March, and April than for the years 1871–72, but not any higher than for other periods of two years in which the cases were not as numerous as in 1885–86.

These observations also embraced a consideration of the relation of the seasonal influences to the mortality rate—a question of considerable interest and importance. Preliminary to an attempt at showing the influence of seasons on the death-rate, it is deemed needful for purposes of clearness to introduce the following table, in which is indicated the number of cases in which the termination was noted, their source, the death-rate for each institution, as well as for those gleaned from private practice, in percentage and the mean general death-rate:

TABLE VII.

Source of cases.	Number of terminations recorded.	Number of deaths.	Percentage of deaths.	General average mortality.
Blockley Hospital . . .	1095	73	6.29 per ct.	6.57 per ct.
Pennsylvania Hospital . .	523	27	5.1 "	
Episcopal Hospital . . .	71	9	12.6 "	
Presbyterian Hospital . . .	......	......	....	
Johns Hopkins	16	3	18.75 per ct.	
German Hospital	9	3	33.3 "	
Private practice	96	4	4.16 "	
Total	1810	119	6.57 "	Average

Reckoned from the above table it was found that as compared with the number of cases, the death-rate for April is lower than for March, June, September, October, and December, the highest death-rate in these statistics occurring in June and the next highest in September.

The results of the present researches justify the following conclusions: 1. Erysipelas is to a considerable extent dependent upon seasonal influences. 2. Certain leading climatic elements have a decisive, though, perhaps, slight causative influence. 3. Among meteorological factors temperature has least and the mean relative humidity the most intimate connections with the disease. 4. *A low barometer and mean relative humidity invariably correspond with the annual*

period in which the greatest proportion of cases occur, and the highest mean relative humidity with the months affording the fewest attacks. 5. Erysipelas is not to the same extent as chorea and rheumatism related to the seasonal variations in the totality of human illness. 6. The mortality rate is but little if at all affected by seasonable influences, since the periods of highest death-rate were too brief to be regarded as being attributable to seasonal conditions.

DISCUSSION.

Dr. Smith: Has Dr. Anders thought of the question of ventilation at the different seasons in private houses and public institutions as influencing this matter? the season having a good deal to do ordinarily with that question. Where the houses are closed and the ventilation imperfect, smallpox, for example, is most prevalent.

Dr. Brannan: I would like to make a suggestion as to the increased prevalence of erysipelas in April, at which time I understood the Doctor to say the highest point was reached, and gradually approached that during the winter. I know March has been my heaviest month of illness; and last winter I was frequently asked by patients why there was so much sickness; and I suggested the grippe, which always satisfied them. I have thought possibly that, among the better class, it was due to fatigue of the winter, which began to show itself in the spring, and they yielded more readily to exposure, especially in such winters as we had this year.

As the Doctor speaks of erysipelas as an acute infectious disease, I think we yield to those diseases when debilitated and ill first from other cause. That may possibly explain its prevalence in April. In March they are sick from other causes, and yield in April to erysipelas. I don't know how many of those who had erysipelas in April were sick in March. I simply offer this as a suggestion.

Dr. Leonard Weber: My own observations in private and hospital practice agree with the statistics as given by the Doctor. The largest number of cases of erysipelas have come under my care for treatment in the winter months from November to March or April, and altogether more in January and February than in any other months.

If there is anything well settled now, where we again begin to doubt the bacteriological origin of disease, it is the fact that erysipelas is a contagious disease. I think that if any coccus has been well described and proved, it is that of the streptococcus erysipelatus of Fehleisen,

which when introduced in the cuticle of the healthy person will invariably produce this disease. If this is so, and I have no reason to doubt it, as every one will concede erysipelas is eminently contagious, there must be in all cases an abrasion of the skin, whether at the side of the nasal orifices or the lobe of the ear, as we deal with facial erysipelas, where the virus can enter, as it cannot infect the sound skin. I think that is pretty well settled. But on the other hand, nothing is proven with regard to the reason or causes why the disease should be more prevalent in the months of the year mentioned than at any other time, unless we may say the virus at those particular seasons is more active, belonging, perhaps, to some variety of germs that flourish in the fall and winter, like germs that are responsible for epidemics of catarrhal diseases.

The contagiousness of erysipelas is particularly well shown also in the instance of sailors, as cited by the Doctor, who are very liable to it also at those particular seasons of the year. To be sure, the sailor on shipboard who has this contagious disease conveys it to others whenever they are liable to infection by having abrasions of the skin; and such they frequently present.

Dr. Curtin: Sailors are subject to great changes of temperature as well as to frequent wettings with salt-water, sunburn, and abrasions (?), all of which furnish the traumatic condition favorable for the onset of the disease.

Dr. Musser: One would be in despair to solve the seasonal influence on disease, it seems to me, as there are so many etiological factors to be considered. This is particularly true of chorea and erysipelas, which is referred to in the paper of Dr. Lewis.

There are so many local conditions in erysipelas which are to be considered as effects, which conditions, it is true, may be more permanent during the spring months than any other time of the year, yet such conditions can obtain at other seasons. This very element of contagiousness makes it a very uncertain one as to the value of any statistics which show the spring as the favorable season.

During the early winter a case was admitted to my wards at the Philadelphia Hospital, and in the adjoining bed, with chronic ear disease, was a patient who developed erysipelas of the ear, and an attendant in the ward developed erysipelas of the scalp, and another patient developed from the same case. This is a disturbing element in reckoning the seasonal influence on the development of disease. It depends largely on the lines of thought in studying etiological relations. Thus in chorea, some think season has a marked influence, and others look upon diet and regulations of life as having a marked effect. Dr. Lewis found that chorea was most prevalent in March; but the element of diet can come in there, as in winter the diet of the patients most liable to this disease is of the farinaceous kind and saccharine,

and less vegetable food. If this class of food has anything to do, as many think, with the development of these neuroses, it would be more operative after they have been fed on such a diet for some time. Another person investigating disease from another standpoint would prove that such and such causes are operative. It is, as I said, extremely difficult to attempt to decide the influence of season or of any one element in the causation or development of such disease.

Dr. Anders: Dr. Smith called attention to the question of ventilation. I regret to say that no attention was paid to this particularly. The hospitals of Philadelphia are quite as well ventilated as those of other cities during winter and spring; and they are certainly not less effectively ventilated in the spring than in the summer or autumn, when there are a greatly reduced number of cases.

Dr. Brannan, referred to the March increase in disease, as probably due to exhaustion. The results obtained by Dr. Lewis show that there is a general increase in the totality of human illness during the month of March. Now, whilst the summit of the curve for general illness is in March, that for erysipelas occurs in April. Hence the exhaustion theory cannot account for the general augmentation of disease in March and the striking increase in the proportion of erysipelas cases during April.

The next speaker referred to abrasions as a factor in the causation, I am heartily in accord with that idea. It is a great question whether or not nearly all cases ought not to be regarded as traumatic rather than idiopathic. The more we investigate this question the more often do we find slight abrasions on the nose, face, or the ear to account for the manner of infection. It is not, however, the specific germ of the disease or the manner of infection that these investigations were intended to show, but the influence of one of the predisposing factors.

Dr. Musser referred to local conditions and the diet, etc., as possible causes of erysipelas. That aspect is treated of in the paper. The traumatic cases occurred |in small groups (one following upon another in quick succession, showing, doubtless, endemic influence; and unhygienic conditions always have their ill effects.

There are still many things undetermined relative to the subject of the seasonal influences in this and other diseases. As before stated, the present investigation was not undertaken with a view to disproving anything pertaining to its bacteriological origin or the manner of infection, but to determine the part played by the various meteorological factors in the production of erysipelas.

OCULAR DISTURBANCE DUE TO CLIMATIC INFLUENCE.

By S. D. RISLEY, M.D.,
PHILADELPHIA.

When your President honored me with an invitation to present a paper upon ocular disturbance due to climatic influence I hesitated, because I was not a member of your society, and also for the reason that I have had limited opportunity to study eye diseases outside of the environments of our Eastern seaboard.

It is very difficult to differentiate between climatic influence and racial peculiarities, on the one hand, and the peculiarities of immediate environments, on the other. For example, a study of hospital statistics and clinical reports made by ophthalmic surgeons in Europe and in different sections of our own country reveals the fact that certain forms of conjunctival and corneal diseases are much more prevalent in some sections than in others. In the clinics of Europe, cases of trachoma, *e. g.*, are very much more numerous than in Philadelphia, and during a recent visit to the northwestern section of the United States I was much impressed by the relatively large number of patients under treatment by my friends in that section for this rebellious form of conjunctival disease. They were disposed to account for the fact by the high winds carrying clouds of dust, by the exposure in agricultural communities to the strong light in the harvest-field for many hours daily, and the cold winds and strong snow-light through the long and severe winter.

Your President, Dr. Curtin, has pointed out in an admi-

rable manner in a paper presented to this Society, in 1886, on "Rocky Mountain Fever," the deleterious influences of the alkali plains on other mucous membranes. The irritating alkaline dust is doubtless the cause also of chronic inflammation of the conjunctiva and cornea as well as of the upper air passages. The so-called Egyptian ophthalmia is the same form of disease.

Of late years we have come to recognize another form of ocular disturbance due to climatic influence, viz., the malarial affections of the eye, of which I have seen many examples. They consist in affections of the conjunctiva, cornea, and deeper tunics. I published a group of these cases in the *Therapeutic Gazette* for February, 1892, in a paper on "Ocular Manifestations in General Disease." The most frequent malarial disturbance has been affections of the cornea which do not conform accurately to other recognized forms of corneal disease, are periodical in character, and recover under antiperiodic doses of quinine or arsenic. The periodicity consists, when of the tertian type, in the eye being much worse on the day on which the paroxysm occurs. Since there is ordinarily actual tissue change, usually superficial ulceration, or abrasion of the corneal epithelium, the eye is never well, as there is not time for repair between the acute exacerbations.

When the cause is discovered, it is gratifying to see the rapid recovery made under large doses of quinine. Another type I have occasionally seen is where recurring attacks of corneal disease have appeared on the fourteenth, twenty-first, or twenty-eighth days in patients living in districts well-known as malarial. I have also seen cases of recurring retinal hemorrhage in which the attacks came approximately on multiples of seven days. In one of these cases, the presence of the corpuscles of Laveran were demonstrated. Two of these cases are comprised in the published group already mentioned. Many others have pointed out the influence of malaria in causing ocular disease. It is, therefore, quite certain that malarial climates are fraught with danger to the integrity of vision, not only indirectly through the general impairment of health, but

directly, as in the occurrence of intra-ocular hemorrhages during the cold stage of the paroxysm.

There are also forms of rheumatic eye disease which, if not directly produced by the climate, are certainly very much aggravated by living in cold, moist districts. I have patients subject to recurrent rheumatic iritis who are comparatively free from both their rheumatism and iritic attacks during the summer season at home or while spending their winters in Florida. What effect the dry and equable climate of Colorado in the region of Denver and Colorado Springs may have upon this class of cases is an interesting inquiry.

During a recent visit to the higher altitudes of Colorado, I was much impressed by the annoying symptoms I experienced. The mucous membrane lining the upper air-passages became turgid, and so swollen as to quite close the nostrils, the voice became dull and hoarse, there was marked tinnitus and some dulness of hearing. The conjunctiva was congested, and there was a deep-seated post-ocular pain. I cannot but think that prolonged subjection to such disturbance must favor the occurrence of chronic hyperæmia and inflammation of the ocular and nasal mucous membranes.

In patients suffering from sclerosis of the arterial tree, particularly in the early stage, when the arterial walls have not yet been reinforced by connective tissue in the intima, the results might be anticipated with some dread that intra-ocular or even intra-cranial apoplexies should occur. I have been much interested in the papers presented to the society by Dr. Frank Donaldson in 1887, on the "Causes of Cardiac Failure in High Altitudes," and by Dr. J. T. Eskridge on "Nervo-Vascular Disturbance in Unacclimated Persons in Colorado."

My interest in the possible influence of high altitudes over vision was greatly enhanced by a case brought to me from Colorado Springs in May, 1891. The history I have deemed of sufficient interest to present for your consideration. I do so in the hope that it may elicit some expression of opinion upon the part of those living and practising in that section.

Jane Smith, aged twenty eight, house-servant, was brought

to me May 12, 1891, by her employer, who, fearing that her trusted servant was going to lose her eyesight, travelled with her from Colorado Springs to Philadelphia, and handed me the following interesting letter from her physician, Dr. J. R. Robinson, of Colorado Springs:

COLORADO SPRINGS, COL., May 8, 1891.

DEAR DOCTOR: Mrs. Jane Smith consulted me on March 14th, on account of failing vision of the left eye, which she first noticed a few days previous to that time. Her vision was, O.D. 20/20, O.S. 20/40. During the examination vision seemed to vary in the left eye, dropping as low as 20/70 for a moment and again rising to 20/40. The only history elicited was pain in the left temple and orbit for a few days, but of moderate degree. The only change I could find in the fundus was a decided enlargement of the inferior branch of the central vein. The following day a like change was noted in the upper branch, and the vision had fallen to bare light-perception.

On March 17th there was total blindness, the lower vein was somewhat shrunken, and I could find no trace of the arteries of the disk. I could detect no haziness of the retina, in fact—no changes except as above noted.

On March 19th there was no change in the fundus, but there was a little return of vision in the left field—the movement of my hand could be distinguished here at a few inches.

I saw the case no more until May 1st. She could then count fingers at three feet with the left eye. The circulation was re-established, but there seemed to me to be beginning atrophy of the optic nerve. The right eye was normal.

On May 2d the patient complained of failing vision of the right eye, V. = 20/200. I could detect no change in the fundus to account for it.

May 4th. Claims she can barely see people crossing the room, but counts fingers at six feet. I called in Dr. S. W. Morrison, who had confirmed what I have described as having found in the left eye, but he could find nothing abnormal in the right. The fundus seemed to us both to be normal. I have not seen the case since, but I am very much interested to know what you think of it.

As to my diagnosis, I inclined to embolism of the central artery in the left eye, although many of the symptoms usually found were absent. I confess that I am now unable to make a positive diagnosis. There is much in the case to suggest hysteria, but some change may have occurred by the time the patient reaches you to make the diagnosis clearer. My treatment was expectant at first, later strychnine

and galvanism for left eye. Have given her no specific treatment, as I could elicit no history of specific trouble.

When Dr. Robinson saw her last, on May 4th, vision had sunk in the right eye to "counting fingers at six feet." The left was quite blind, there being only quantitative perception of light, and that in the temporal field only. On May 12th, after her long journey to the East, I made the following record: O.D., V. = 5/200, O.S., .V. = 3/200, but acuity is variable—for an instant able to see smaller letters, and a moment later cannot distinguish any object. The most careful study discovered no general cause for her eye symptoms. She had had severe trouble with her teeth, accompanied by severe headache just prior to the onset of the ocular symptoms, but her dentist, Dr. H. L. Gilmour, who examined her teeth once more at my request, reported her denture in good condition, and nothing in the mouth to cause reflex symptoms.

There was now no headache or vertigo. She slept and ate well. The patellar tendon reflexes were exaggerated. The pupils were too large but equal, and reacted both to light and in accommodation. She had the stare so characteristic of a person blind from atrophy. Her general appearance and movements were those of a blind person. She was listless, sluggish in all her movements, and indifferent as to her future.

O.D. field for form normal, also normal for red at first, which then fades out, and she is unable to recognize any of the colors. My note is unfortunately silent as to any change of the form field after the loss of color-perception, but at no time did it show any tendency to spiral contraction. The optic nerve at outer half was gray-green, with sharp margin and devoid of bloodvessels. Inner half is still capillary but grayish. No notable change in the large vessels.

O.S. field for form normal, but lost for red, except for a small area in nasal field. Optic disk is greenish-white throughout, entirely devoid of capillaries. Central arteries and small veins normal, or possibly too full. In a word, the left optic disk presented a typical picture of rapidly progressing atrophy. At her first visit a grave prognosis was given but no treatment advised.

She was sent to the dentist for an examination of the teeth, and a specimen of urine requested. The following day, May 31st, she reported with a note from the dentist as given above, and result of examination of urine was negative. She thought her vision was better, and examination showed V. = 10/200 in each eye, a marked increase. In all other respects her condition remained the same.

She then received the quadruple chlorides internally, and a weak collyrium of eserine to be used morning and evening.

On may 16th, V. = O.D. 15/200 ; O.S. 5/200. Strychnine sulphate gr. $\frac{1}{30}$ t. d. was added to the dose contained in the chloride mixture.

May 26th, after ten days at the seashore, reports her vision greatly improved. There was a well-marked diminution in the general dulness, and she moved about with more alacrity. O.D., V. = 20/200 readily. Field for form, blue and green normal, but red is seen with some uncertainty in any part of the field, and not at all at point of fixation—*i. e.*, central scotoma for red. O.S. now shows concentric narrowing of the form field, and is blind for all colors. Strychnine increased to gr. $\frac{1}{16}$.

June 9, 1891, the ophthalmoscope now shows a well-marked improvement in the color of the right disk : V. = 20/40. On the left side, however, there was an apparent diminution in the calibre of the central vessels, and the atrophy seemed progressive. Notwithstanding these ophthalmoscopic changes vision had risen to 15/200.

On June 23d she returned with vision in O.D. down to 2/200, but curiously enough had slightly improved in O.S. to 20/128. She related that on the 20th she had noticed "numb" feeling in her right arm, which would "come and go," and awoke in the morning with a severe frontal headache, worse on right side. While at the office there was no loss of sensation, and the tendon reflexes were markedly exaggerated. Right pupil larger than the left, but both react with light and to accommodation. Central scotoma for all colors with each eye, but a small white spot one millimetre in diameter was seen

with difficulty at fixation-point, now and then being lost to perception. She was just on the eve of her menstrual flux. All medicine was stopped, and ascending doses of potassium iodide ordered to be commenced after the menstrual period. She herself thought her vision would be better after the flow had commenced, and inquiry elicited the fact that vision had been more impaired for two or three days during her menstrual period since the onset of the ocular trouble, but not before.

On July 7, V.= O.D. 20/40; outer half of nerve green. O.S. 20/50; nerve green throughout, vessels small.

On September 22, O.D. V.= 6/7.5; no change in ophthalmoscopic picture. O.S., V.= 6/12.

On October 15, O.D.,V.= 6/6, failing before line of letters could be finished; field normal and scotoma for red had disappeared on both sides. O.S., V.= 6/7.5; nerve still green and would pass for an eye blind with atrophy, but the central vessels were not so small as before. Slight concentric narrowing of field; no scotoma.

It may be claimed that the treatment proved curative in this case instead of the five months spent at the level of the sea. The strychnine and potassium iodide, it is true, often seem to retard the progress of some forms of optic-nerve disease, but I have never witnessed so complete a restoration of vision in nerves with such apparently advanced atrophy as in this case, or such an extraordinary return to the normal color in optic nerves as occurred in this patient a few months later.

She returned to Colorado Springs in October, and the following March, 1892, a careful study by Dr. Robinson, which he kindly forwarded to me, revealed no tendency to a recurrence of her visual disturbance and no change in the ophthalmoscopic picture. Fields were normal for form and color.

DISCUSSION.

Dr. Ruedi: I am sorry that Dr. Risley has not read the paper written by Dr. Rivers two years ago referring to the subject. He has done a great amount of work in that line.

As far as I remember, the diseases of the conjunctiva are most frequent in the form of congestion and sometimes ulceration. Then comes neuritis. The cornea is not often affected, but frequently the optic nerve is, by the strong light, particularly the reflected light of the snow. Those people who go into the high mountains and walk on the snow for several hours become often absolutely blind; and the pain becomes so great that they can scarcely move, and have to be carried or taken down into the valley by other people. This disease is also a neuritis, but it is an exudative neuritis. An exudate is seen on the optic nerve by the opthalmoscope. By continuous cold applications and leeches on the temple the exudate is absorbed. But frequently a change to the valley, where the green color is predominant, gives the patients relief. I do not think it is so much the altitude itself as it is the powerful light, and particularly the reflected light of the snow, as we see it from the glaciers in Switzerland having the same effect. If you walk over a large glacier and shelter the eyes with blue spectacles you are pretty safe from eye-blindness: but your nose and face skins so that by the time you get over the ice-fields you look as though you had acute erysipelas.

THE MANAGEMENT OF THE CONVALESCENT STAGE OF PHTHISIS.

By THOMAS J. MAYS, M.D.,
PHILADELPHIA.

There is no doubt that many a consumptive is often safely steered through the perils of his disease by intelligent advice and direction of his physician, only to relapse and to die in the course of a year or two after he has left this care; and it is to the after-management—to the economy of the convalescent period—that I shall devote a few words to-day. I think the fault here lies more with the patient than with his medical counsellor, although I fear we all have too much of the feeling that the phthisical invalid, after he is well enough to do without medicine, will go on to full convalescence guided by his unaided instinct. Very frequently this is a grave mistake. For the individual who was a consumptive once will ever after preserve the trend of a consumptive, unless he moves in a direction different from that which he formerly pursued; or, in other words, if he wants to escape being an active consumptive again he must shun the conditions, the habits, and associated influences which were elements in bringing on his trouble originally. Hence, he who engineers an individual not only through the active stage of phthisis, but on to permanent health, must be not alone a physician, but must also take upon himself the function of a teacher. He must not only study the disease, but the individual from every standpoint. He must comprehend the nature of the active and predisposing causes of the disease, must thoughtfully consider the peculiar relations which the patient holds to his past and to his future, and, above all,

he must compel the patient to realize his own weaknesses, and educate him, not only to lead, but *how* to lead, a different mode of life—a life which will deliver him from the temptation and the susceptibility of his malady.

In dealing with this subject I shall, in the first place, give a résumé of the principles which I believe should be followed in the treatment of the active stage of phthisis, and then deduct from these the course to be pursued in directing the future mode of life of the patient. Whatever else is said and done, I am convinced that there is nothing so potent in alleviating phthisis as protracted physical rest, and nothing so harmful as ill-advised physical exercise. The idea of exercise in phthisis is based on a wrong foundation. It assumes that, because exercise gives strength when taken in health, it must do the same thing in disease. It must be remembered, however, that health and phthisis, in so far as they are related to exercise, have very little in common. One represents an abundance of energy and vigor, and the other an exhausted state of the vital resources. One is equivalent to a plethoric bank, and the other to a financial institution which is verging on bankruptcy. In applying this same logical principle further, I would say there is nothing better established than that money makes money; hence, he who has moneyed capital can always accumulate money. But the banker whose capital is reduced to a minimum, and whose income barely equals the amount of his expenditures, must do either one of two things if he expects to escape being pushed against the wall: he must either increase his income or diminish his expenses. If he does both, he will recover himself sooner than by doing either alone. Now, I look upon the consumptive as being in a condition akin to that of the banker who is threatened with financial bankruptcy. He is threatened with physiological bankruptcy. His wasting, his general weakness, his easy fatigue, his shortness of breath—which is out of all proportion to the lung area which is involved, the slight rise of evening temperature, the anorexia—all indicate that he is suffering more from general exhaustion than from local pulmonary disease. What is

best to do under these circumstances? Is he to go on and drain his strength still further by physical exercise? No; he must economize his forces; he must call a halt in his expenditures, and, if possible, increase his physiological income. How may he best accomplish this?

We know that the bodily forces are expended chiefly in carrying on the functions of respiration, circulation, digestion, voluntary muscular motion, etc. The first three functions which have been named are indispensable to life, while the last, although through it about one-fifth of the energy of the body is expended, is not requisite to life; hence, by cutting off this, as we do when we place the patient at rest, quite a saving of vital capital is effected. Evidently, this must be followed by beneficial results; for that part of the limited physiological capital which was previously diverted, and needlessly expended in the support of voluntary muscular motion is now distributed to the maintenance of the other and more essential functions. Practically, the advantage of this new adjustment soon shows itself in various directions. The digestion improves, the breathing becomes easier, the cough and expectoration diminish, the heart becomes stronger, and, altogether there is an air of vigor about the patient which was absent before. On observing this improvement, one is often puzzled to know the reason for the all-prevailing opinion that the salvation of the phthisical depends on plenty of exercise. No greater stumbling-block was ever put in the way of practical medicine, and I desire to raise my voice in its utter condemnation.

Next in importance to rest comes nutritious food, such as freshly expressed beef-juice, beef-powder, beef, eggs, milk, oysters, etc., and last, but not least, drug medication.

Before I discuss the main part of my subject I desire to refer to the practical results which I have obtained during the last eighteen months by adopting the treatment which has just been outlined. This pertains, however, only to those patients, twelve in number, who have made the most decided improvement during this time.

Male, aged sixteen years, in the incipient stage, gained fifteen pounds in two months. He was kept in bed three weeks. Disease arrested; resumed his vocation.

Male, aged thirty years, gained sixteen and three-fourths pounds in four months. Kept quiet for about two months. Disease arrested; resumed work.

Male, aged thirty-four years, gained twenty-two pounds in five months, and has been working for a year. Rested for a month.

Male, aged twenty-two years, gained eleven pounds in six months. Rested in bed four weeks. Disease arrested.

Male, aged eighteen years, gained sixteen and three-quarter pounds in six months. Remained quiet three months. Disease believed to be permanently arrested.

Male, aged thirty-five years, gained fifteen pounds in seven months. Rested two months. Believed to be cured.

Male, aged twenty-eight years, gained twenty-nine and three-quarter pounds in four months. In bed six weeks. Disease arrested.

Female, aged twenty-four years, gained twenty-one pounds in five and a half months. In bed six weeks. Believed to be cured.

All but the first of these cases were in the advanced stage of phthisis, *i. e.*, there was pronounced pulmonary infiltration in all but the last one, and all of them were greatly emaciated.

Female, aged thirty-four years, gained twenty-seven and a half pounds in one year. She was kept quiet for six months. Her disease is arrested.

Female, aged thirty years, gained twenty-two pounds in six months. She spent three months in bed and on a lounge. By going to Colorado in the winter season, and against my advice, she lost all she had gained, and is now practically dying.

Male, aged twenty-two years, gained twelve pounds in about six months. He was kept on his back for three months. Disease is arrested.

Male, aged twenty-seven years, gained nineteen and a half pounds in one year. In bed for ten weeks. Disease arrested.

The last four cases were all in the far advanced stage of phthisis, all but the last but one having cavities in their lungs, and he suffered from what was believed to be intestinal tuberculosis. In the aggregate these twelve patients gained two hundred and twenty-eight pounds, or an average gain of nineteen pounds for each patient. I have treated a number of other cases in the same way, with practically the same results, excepting that the gain in weight was not so marked.

Now, after a patient has been so far restored as to be able to go to work, the question arises as to what is the best course for him to pursue. In other words, how shall his stage of convalescence be managed? The principles of treatment which have secured his recovery thus far must now also serve him as his future compass.

He must, therefore, first be taught to avoid becoming tired and to forego all physical strain. There is no reason why he may not be fatigued, provided this is readily put to one side by rest and food; but when he tires himself to such a degree that he feels weary and exhausted from morning until evening, and fails to be refreshed by food or sleep, it is evident that he is suffering from excessive irritation somewhere, and that the body is wasting its resources faster than it receives them. Straining, such as comes from lifting, running, jumping, etc., should be shunned in order not to throw any excessive burden on the weakened bloodvessels of the lung, and thus avoid the danger of hemorrhage from this source.

Second, there should be no decrease in weight, except that which is in keeping with the ordinary fluctuations of health. This point should be carefully watched. Continued uniformity of body-weight is evidence of good health. Steady diminution of the same, be it ever so small, should always cause apprehension in anyone who is predisposed to, or a convalescent from, pulmonary consumption, and should lead to inquiry concerning the cause of the decline.

Third is the importance of eating. There are, of course, many persons who are very poor eaters, and who yet do not fall a prey to consumption. Such persons do not require much fuel,

because their fire of life burns low; but those who are predisposed to consumption, and especially those who are coming out of the jaws of the disease, so to speak, are in pressing need of an abundance of rich, nutritious food. They should be made to eat regularly, and as much as if they were going through an active siege of the disease.

Fourth, pulmonary gymnastics. Very few if any persons ever completely inflate their lungs except when they make a special effort to do this. This is due to the fact, as has been experimentally demonstrated by Mosso, that our breathing-surface is about one-fourth larger than is necessary for the ordinary requirements of life; hence there is always a certain part of our lungs which is practically idle, more or less, all the time. This peculiar physiological relation has an important bearing on the question of air-supply to the body. Is it true, as we are constantly reminded by writers on hygiene, that the human race would be less subject to disease, and particularly to consumption, if the air we breathe contained a greater abundance of oxygen? I do not believe that there is a particle of proof to sustain this proposition. For, aside from the fact that three-fourths of our respiratory surface is capable of furnishing the requisite amount of oxygen for the ordinary pursuits of life, we know that a large portion of the inhaled oxygen is not abstracted by the blood, but returns with the expiratory air. Indeed, as we view this subject from the point of developing the chest-capacity, we are forced to the conclusion that phthisis would be much less common if the air we breathe were deprived of a portion of its oxygen. People living in the rarefied air of high altitudes have larger chests, and are less liable to phthisis than those living in lowlands, and it is conceded that the beneficial influence of high mountain air on this disease is largely attributable to the deeper and fuller respiratory movements which are necessary to obtain the requisite amount of oxygen for respiration from the attenuated air. So far as pulmonary consumption is concerned, it is, therefore, not so much a question of an abundance of oxygen in the air as it is one of complete lung-expansion; for, owing

to the downward distribution of the large bronchial tubes, the lower parts of the lungs are filled first and most completely, and the apices last; hence, if the lungs are not fully distended, it falls to the lot of the apices to remain idle, and it is in a great measure owing to their inactivity and consequent weakness, that the upper parts of the lungs mark the beginning of consumption in the great majority of cases.

It is very essential, therefore, that the whole lung surface should be developed, and be made to take part in the function of respiration. To achieve this end, deep voluntary breathing should be encouraged at intervals of an hour or two throughout the day, and for ten or fifteen breaths in succession at a time. This can be done everywhere, care being, of course, taken that the air is inhaled only through the nose, especially in the open air, so that the latter is fairly warmed before it reaches the lungs. Among the many breathing exercises, the following movements may be practised with good effect: The arms being used as levers, are swung backward as far as possible on a level with the shoulders during each inspiration, and brought together in front on the same level during each expiration; or, the hands are brought together above the head while inspiring, and gradually brought down alongside the body while expiring. Another very effective method to expand the chest is to take a deep inspiration, and during expiration only the person will count as long as possible in a loud voice.

The breathing of compressed or of rarefied air is the most powerful means at our command for increasing the breathing capacity. The best apparatus for the accomplishment of this purpose is the pneumatic cabinet, in which air may be compressed or rarefied according to the indications of each case.

Fifth, physical exercise. While physical exercise must be entirely avoided, or guardedly employed, during the activity of the disease, it is very desirable that it should be advised under limitations during convalescence. One of the most efficient modes of bodily exercise is walking, and this is a power which is common to most people; but, whatever the mode of exercise

may be, great care must be taken that it does not tire or become wearisome.

Sixth is the selection of a suitable occupation. This is one of the most important and sometimes one of the most difficult things to carry into effect. If the former occupation of the consumptive proved injurious it must be given up and another one substituted. All such occupations as stone-cutting, milling, glass-blowing, type-setting, file and shoemaking, tailoring, painting, dyeing, weaving, hatting, brass-founding, working in phosphorus and quicksilver, etc., are harmful, and must be abandoned. Among the more healthful are farming, laboring, canvassing, civil engineering, surveying, commercial travelling, stage-driving, huckstering, railroading, etc.; while clergymen, physicians, lawyers, dentists, students, teachers, editors, reporters, apothecaries, musicians, architects, booksellers, insurance men, grocers, grain dealers, and photographers are remarkably exempt from consumption. Much will, of course, depend on the taste, inclination, and opportunity of the individual in this respect; but whatever the choice of occupation may be, it must be begun gradually, so that the system may become slowly accustomed to the change.

The convalescent's return to work is frequently attended with some of the most serious drawbacks as to his future progress. He is well enough to perform light labor, and could accustom himself to the hardships of work gradually, but is not sufficiently strong to plunge suddenly into severe toil and exertion. This eifficulty can be arranged if he has money, but oftener he is poor, and either has spent all his earnings in his desire to get well, or was, perhaps, maintained by a hospital through his illness. He is now thrown on his own resources, and what is he to do? The battle which was thought to have been won is really just beginning! Shall he resume his former vocation when he feels that the chances are against him and may place him where he was a year or eighteen months before? This seems to be the only alternative in many instances, and many a poor patient goes down under its burden, who, under the influence of more favorable conditions, might be saved.

Every hospital for the treatment of consumption should have under its jurisdiction a country home for convalescents, in which patients could be kept and employed at light labor, and thus become gradually accustomed to the demands and requirements of harder work.

DISCUSSION.

Dr. Smith: I am in accord with what Dr. Mays has said as far as regards the advanced stages; but it seems to me that in the earlier stages we have practically to decide whether the lesion of nutrition is primary and the pulmonary lesion secondary, or the reverse. If the lesion of nutrition is primary, owing to faulty methods of living, which have gradually broken down the powers of resistance, so that an opening is made for pulmonary disease to step in, that is one thing; if, on the other hand, the bacillary infection is primary and the nutrition suffers secondarily, that is another.

First it seems to me, that the question of exercise is not so simple as Dr. Mays has treated it. Suppose a person is engaged in some sedentary occupation and the nutritive powers become weak, and there is deterioration in that way, and ultimately disease is associated with that condition. In such a case the gain which we get from proper exercise is greater than any that might result from conservation of vitality by enforced rest. If, on the other hand, we have the pulmonary difficulty taking the precedence, then the reasoning of Dr. Mays holds good; then the greatest possible conservation of the forces of the patient, with a view to forestalling the bankruptcy which Dr. Mays has so graphically sketched, is of course demanded.

It seems to me that every case has to be judged by itself in this regard. The line of treatment that would be indicated in the later stages of pulmonary tuberculosis would not be so suitable in an early stage; and in each case we must determine whether it is primarily a lesion of nutrition or a tubercular lesion.

Dr. Jacobi: While the Doctor has been reading his paper I have been asking myself, What became of all those numerous cases that I have seen in bed in hospitals? They are admitted to hospitals, they remain there, and we can control them. He has spoken of a number of cases with cavities, and they have gotten well, under the circumstances—in bed, with rest, and with a great deal of good food, such as he has been able to give them. The large majority of cases that I have seen, with good food, under proper supervision, in hospitals have not been so fortunate as the cases the Doctor has described—gradually they will go down and die. It is true a number of such

cases do not come into the hospitals with pyæmic fever and leave temporarily. As a rule, I cannot say that I have been so fortunate as to see so favorable results. On the other hand, I know a great many cases that will be about in the summer-time, and, while there was no doubt as to the diagnosis, will gain flesh and feel better. Altogether I have never seen so many cases as the last year and a half or so—with the medicinal treatment of arsenic and guaiacol, combined with good food. I have seen nineteen patients out of twenty increase under such dietetic treatment as I have followed, with moderate rest, arsenic and guaiacol treatment, as outlined in the TRANSACTIONS of the Society last year.

I have been greatly impressed by what the Doctor has reported. He has not selected the cases, but took them as they came along, and invariably there has been improvement; and there must be a great deal in what he has said, and I think it will encourage everyone to urge absolute rest in addition to what we may do otherwise.

DR. OTIS: It seems to me that Dr. Mays is misleading in one respect. He speaks of physical exercise as one thing and lung exercise as another. I consider it all physical exercise. You send a patient to a high altitude and tell him to rest—at least in certain cases—put him out of doors in a reclining chair, and tell him to keep quiet. He is not resting, but taking the best of exercise he can. The rarefied air compels him to breathe deeper and faster; the respiratory muscles get greater exercise than before, so it seems to me proper to put this under the head of physical exercise. I think this is the most important point Dr. Mays has dwelt on. I have examined 1200 to 1500 chests in the last four years to determine the degree and kind of breathing and expansion, and I agree with Dr. Mays that there are very few individuals leading ordinary lives that breathe fully and properly. It seems to me that this fact cannot be dwelt on too strongly in treating phthisical patients, particularly those in the first and second stages, viz: that they be taught proper lung gymnastics, to breathe fully and properly.

I believe, if it be possible, in examining the suspected cases, and I think it is possible, that we should not only auscult and percuss them, but take all the different measurements of the chest as to expansion and the vital capacity of the lungs; then we should be in a position more efficiently to advise them than by the knowledge obtained by simply auscultating and percussing.

It has been impressed most emphatically on my mind that the indidividual of sedentary habits does not know how to breathe, or at least does not expand the lungs properly.

DR. GIHON: I merely wish to supplement Dr. Otis' remarks about vital capacity. During the years while I was President of the Board of Examiners at the U. S. Naval Academy, Annapolis, Md., through

most of which my friend and colleague, Medical Director Gorgas, of the navy, now present, was associated with me, very few boys of the large number who came before us were found able to expand their chests as they should. I do not know whether Dr. Otis is paying any attention to the difference between the sexes is this respect. While only males were within our purview, a number of young women presented themselves through curiosity or other motive, and I cannot recall an instance—in which Dr. Gorgas can support me—where the vital capacity of the female was comparable with that of the male, neither breathing anything like the normal amount.

Relative to Dr. Mays' remarks about rest as a factor in the treatment of pulmonary consumption, I do not believe that mere rest in bed is of any particular benefit. Those of us who have had charge of naval hospitals have seen consumptives bedridden month after month without especial improvement. But if you can have physical rest under proper climatic conditions, as in the valley of Orotava, on the island of Teneriffe, where you have altitude with absolutely equable temperature and dryness, where the doors and windows never need be closed, night or day, where the invalid can be at rest, as it were, all the time in the open outdoor air, the only muscular efforts being the gentle movements of the chest expanded to its utmost by the altitude, where there is during the day the influence of sunlight without its over-stimulating effect, being filtered through clouds thousands of feet high, where the senses are lulled by the rhythmic sound of running water coursing through channels in front of the house—there you may witness the recuperative power of rest, which you see so often on board ship on long voyages in pleasant weather over smooth seas in tropical and extra-tropical latitudes. At Orotava, as in a somewhat less degree in Madeira, the Azores, Hawaii, and other mid-ocean islands, you have first the lavative ocean climate, equable temperature, and moisture, absence of discordant noises, dirt, and foulness, and tranquillity of all the bodily functions, except the nutritive, which is actively repairing waste under the most favorable conditions. I believe that nine out of ten consumptives under such surroundings can live protracted lives, if not get well. Rest such as this is undeniably the most desirable therapeutic measure in this disease.

Dr. Bowditch : I think we all recognize the value of rest in disease. If a patient returns to the same conditions of life under which he developed the disease, he is likely to go on as though he had had no treatment at all. That, it seems to me, is one of the most important factors in the treatment of phthisis. I think rest treatment in phthisis is a matter of individual treatment—that is, recognizing individual peculiarities. I feel by my experience at the Sharon Sanitarium the importance of watching everyone at first, keeping him

quiet at first, to see what the result will be; then slowly increasing the amount of exercise. I have over and over again found patients disobeying orders about walking up hill, thereby sending up their temperature; and they recognize this themselves after a time. I let them keep on level ground at first.

In this connection it seems proper to me that we make some allusion to one form of respiratory gymnastics, for such it can be called. Bicycling, if properly done, is one of the best methods for expanding the chest; and if improperly used is one of the very worst, and we, as physicians, cannot too strongly warn parents against the danger of allowing children to ride with curved backs and hollow chests, a form of exercise hideous to look at, most deleterious to the action of the lungs, and absolutely unnecessary in the proper use of the bicycle according to the opinion of experts.

Dr. Quimby: The fault is not in the bicycle, the difficulty is in the fool, the man, the fellow who uses it. I have a patient who came to my office and came back in three mouths so changed I did not know him. I have seen it do the opposite—he rode the same make of bicycle over the same road.

I have but two points to make in Dr. Mays' paper which trouble me somewhat. The first is, in the beginning we are apt to criticise statements directed at a single point and do not cover the case. I do not wish to criticise the statements made in this paper, but with relation to other facts.

In considering disease, we must learn to consider carefully the causes of the disease. It seems to me that it is very incomplete—particularly in this, the causes and the degree. The convalescing patient in disease and the convalesced are very different. That brings me to the second point. If Dr. Mays would give us the value of rest, not in consumption, for there is no such thing as pulmonary consumption itself, pulmonary consumption is simply the result of a combination of all sorts of diseased forces of the body. If Dr. Mays will tell us which of the particular forces rest acts on, so we can use it judiciously, then we will be able to gain what he has apparently in his experience. We do not question Dr. Mays' or Dr. Jacobi's results. We are attempting to cure a thing as a whole, when we are absolutely forced to cure a thing as a product. If we turn attention to each thing by itself it would be better. I read an article in which it was insisted that large flushings of the large intestines was all that was sufficient to cure phthisis. I have been washing out the lower bowel in phthisis and other troubles, and they got well. I have time and again seen the temperature go up and have seen it come down after flushing, but I never flattered myself that I was doing anything more than treating a systemic indication; and that I was doing the same in phthisis as in every other disease; and if Dr. Mays would

tell us what force, what factor that goes to make up the product of phthisis—his systemic infection, his nerves, his exhaustion, the particular tissues making the product—or simply increasing the nutrition in every force of the body and avoiding waste: what factor in disease does rest control?

Dr. Ruedi: The rest cure, ever since Weir Mitchell brought it out for nervous diseases, has been made use of in phthisis; there was a man as far back as 1878 who commenced to treat phthisis by keeping the patients in bed—Professor Rossbach. He went so far as to say in his lectures that no one should die from phthisis, and it is true that he kept them alive; he kept them in bed for a year, perhaps two years, perhaps three years, and under the very best conditions; but as soon as they got up and moved about, then there was again this difficulty. Rossbach could not prove to have gained curative results by this treatment. Other followers took this system up and combined it with massage, having the patients in bed at the same time. Passive exercise was commenced. It was the same thing over again. Curative results could not be shown. The patients were kept alive, got fat, gained in weight, but the lungs remained nearly the same or only slightly improved.

I do not think it can be the object of the physician who treats phthisis to make the patient fat. We should make the patient strong; to be able to move about; to do work and give himself exercise.

If we look at this thing in another light we will see at what variance the medical profession is. Take a case of hemorrhage from the lungs, What is the treatment now? Paul Niemeyer says, Put the patient on horseback and let him ride; Hoodemaker says, Let him run up hill and get exercise; the majority, and rightly, say, Keep him in bed and give him ice and treat properly. But even in this simple case we see there is a great difference of opinion concerning rest and exercise. In this medical meeting, also, there must be a diversity of opinion. I always try to be in the middle line. I have had my rules by which I treated my patients; I think, on the whole, I can be satisfied with them. As long as they have pyrexia and as long as they have moist crepitation, I keep the patient quiet, but not in bed, let him lie on a lounge, let him move up and down on the balcony, which he can easily do; and here the patient is in the open air; do not keep him in bed in a bedroom, or, if you put him in bed, push it out on the balcony in the open air. The open air is decidedly the best treatment in consumption. What is the use of keeping the patient in bed in a large town or city like Philadelphia, or in a hospital, where the air is bad and open-air treatment cannot be spoken of.

As soon as the moist crepitation and pyrexia is broken by rest, then I at once ask the patients, to do a little more. I advise them to walk on a level, but always to keep three rules in mind—never to get

tired; never to get out of breath; and never to feel the heart. As soon as they get tired, to sit down; as soon as they get out of breath, sit down and rest; and as soon as they feel palpitation, to sit down and rest, and only to walk so far as they easily can, and to have a camp-stool with them under their arm, and, wherever they are, to put it on the ground, sit down and rest, and then start again when they are rested.

When the patient is so far advanced that there are only bronchial râles and all active symptoms of the disease have passed away, then I maintain that forced exercise, simply and solely to force the lungs to expand again and to increase the breathing-space, is indicated. I have had a method of mountaineering, with posts driven in the ground at every 100 feet difference in elevation. In the beginning the patient had to walk from one post to another in a half-hour; later on, had to walk two posts in an hour, and then three posts in an hour and a half. When he was able to do this, and had done four or five posts, each in a half-hour, then the time was reduced; he had to do the same in twenty-five, later in twenty, and still later in fifteen minutes; and so, by and by, he was accustomed to breath deeper and fuller, and to expand his chest. I think if some attention was paid to systematic walking and mountaineering in the so-called stationary cases of consumption, we would have better results than by the constant rest Dr. Mays has described.

DR. VON RUCK: I believe that the advice of taking exercise for the consumptive has been so constant and universal that it has been resorted to without discrimination. Rest and exercise are both valuable, but the patient who takes exercise when he should be at rest, and *vica versa*, is of course following a detrimental course. With a large experience in managing consumptive cases in my institution, I am satisfied that rest is one of our most important remedies in accomplishing the desired result when the patient has an inflammatory process or septic fever. I do not, however, find it always necessary to confine the patient to the room or to the bed to produce rest; he can be placed on a couch upon the piazzas or other protected place, and thus give him at the same time the advantages of out-of-door life. But when resorting to prolonged maintenance of rest, I find it is not so simple a remedy that all we have to do is to put the patient to bed. It means that we are choosing between two evils, rest being for the time the lesser of the two; to reduce the detrimental effects of such prolonged rest to a minimum, the diet needs special attention, and if not properly carried out, we are confronted with gastric and intestinal disturbances. In addition, we must apply hydropathic means and substitute massage for the want of muscular exercise, if we desire to accomplish the best result. Neither rest nor exercise are curative agents for tuberculosis; both are means for maintaining a better cir-

culation, and thereby a better general and local nutrition. Under the enforcement of rest, less septic material is absorbed into the blood, the fever is moderated, and the septic or inflammatory processes are sooner and better controlled. On the other hand, to put a patient not having such complications at rest in bed for prolonged periods, is a serious mistake, because, without the complications mentioned, patients do better with as much exercise as is well borne, short of producing heart-fatigue, and as the strength and vitality of patients differ, and as there is a difference in this respect with the same patient at different times, only close, constant, and individualizing control by the physician can lead to the greatest benefit in the use of exercise or in the application of rest for the particular case in hand.

Dr. Mays: I am very glad to have heard the discussion which this paper has called out, and notwithstanding the skepticism which has been expressed, I do not think that my results are exceptionable. I believe that the same results can be obtained by us all, provided rest is carried out systematically. This is paramount to everything else in my estimation.

Dr. Smith's question as to whether we regard the disease constitutional or local is a very important one from a climatological-therapeutic standpoint. My experience leads me to believe that the great majority of cases which we meet are constitutional. In a case of acute tuberculosis, however, I would give the local condition first consideration. I heartily agree with him that every case must be judged on its individual merits, even though you pursue a single line of treatment.

Concerning the criticism of Dr. Jacobi, that if rest is of so much consideration, why do so many consumptives die who are confined to hospitals for a long while? I would say that before I realized the value of rest I had often seen the same picture as he described—patients resting in a hospital for months and still not getting well. According to more recent experience I contend that most of these patients did not receive the rest treatment in a systematic manner. They were allowed to control their physical movements—went to bed and got up when they felt like it, and did about as they pleased in relation to exercise. Rest is not insisted on as it must be if the patient is suffering from the active stage of the disease.

Dr. Bowditch has referred to the important fact of the great sensitiveness of the phthisical temperature—that this is readily reduced by rest, and that it readily rises under the influence of exercise. I believe that fever is one of the last elements of the disease to subside. I have had patients under my observation for a number of years, whose disease I considered arrested, and whose temperature, although normal most of the time, will fly up even now from a half to a whole degree above the normal under the strain of excitement, and

remain there from eight to twelve hours. Forced breathing or pulmonary gymnastics, to which Dr. Otis has referred, are very often responsible for the non-improvement and elevation of temperature in this disease. In order to reduce fever I understand that even those who practise in high altitudes are more anxious to cultivate rest than exercise in their patients.

I do not know that I can answer Dr. Quimby's question as to the special portion or force of the human body which is affected by resting the patient. It is not a question with me as to the particular force or part of the body on which it acts. I believe that the body is a bundle of vital forces which move and act harmoniously in health, and anything which disturbs this equilibrium or dissipates these forces interferes with health and life. Now I believe that consumption brings about such a dissipation, and it is by stopping this waste that rest does its good.

When Dr. Ruedi says he endeavors to control the movements of his patients in such a way that they will not become tired, neither get palpitation of the heart, nor get out of health, I think everyone will agree with him; but when he recommends mountaineering to the same patient, it seems that there is an inconsistency between his teaching and his practice. In this I fear his fellow practitioners of the Rocky Mountains do not fully coincide with him. About a year and a half ago *The Climatologist* contained the report of a paper on "The Rest Cure in Phthisis," read by Dr. Keating before El Paso Medical Society at Colorado Springs, in the discussion of which many of its members took part, and, so far as I remember now, there was not one who did not discountenance exercise, such as mountaineering, horseback riding, and roughing it, in the treatment of phthisis.

CONSIDERATIONS CONCERNING ASIATIC CHOLERA.

By A. C. ABBOTT, M.D.,
PHILADELPHIA.

In acknowledging the honor that has been done me by your invitation to address you, I do so with a full appreciation of the importance of the subject upon which I have been asked to speak.

The question that is at present of perhaps the greatest moment, not only to the medical men of this country, and of western Europe, but to the laity as well, is that involving the probable reappearance of Asiatic cholera during the coming summer. I have been asked to present to your notice some of the facts in connection with the bacteriology of this disease, and do so in the hope of contributing to a more complete understanding of the channels through which it is disseminated, and of the fundamental principles that underlie a rational prophylaxis against its spread. In order to do this, I must ask you to accept, without question, the modern teaching in relation to cholera, namely, that it is an infectious disease, depending for its existence and propagation upon a specific micro-organism that is located within the intestinal canal of all individuals affected with this disease. This micro-organism is now generally believed to be that described by Koch, commonly known as the "comma-bacillus" of Asiatic cholera. Though there were for a time after Koch's announcement certain objections to accepting his teachings in relation to the etiology of cholera, these have now practically disappeared, and the weight of opinion is incontestably in favor of the doctrine that he taught.

With the announcement that a definite *materies morbi* most probably standing in causal relation to this disease had been found, the attention of the medical world was at once directed to it, and on all sides efforts were made to become familiar with the characteristics of this organism and the means commonly employed for its identification. Perhaps nothing can give a better idea of the impression made by this contribution than the sudden and continuous increase of applicants for admission to the laboratory of which Koch was at that time director. So great was the demand that it became necessary, in order to satisfy it, to organize special courses of teaching, in which only the questions concerning cholera, its diagnosis, and the means of preventing it, were considered. This widespread interest in the subject naturally opened up channels through which many contributions that have added much to our knowledge of the subject have been received.

In so far as the morphological and cultural peculiarities of the organism are concerned, Koch left but little room for addition to his original description, but this represented only the foundation upon which was to be built a superstructure so rich in experimental data as to warrant our claiming acquaintance with the behavior of this organism under the manifold conditions of environment that it finds, not only when located within the intestinal canal, but when outside the body as well; and it is through investigations of this character that we receive the teaching upon which our plans of public quarantine and of domestic and personal prophylaxis are to be based.

In epidemics of cholera, manifestly, the danger against which we are to guard exists in the evacuations of the afflicted individual; and if the evacuations from each and every such individual were disinfected immediately upon being passed, it is safe to predict that the appearance of the disease in an epidemic form would be a thing unknown. Unfortunately, however, this precaution, simple as it is, is more often neglected than employed, and the consequences of such neglect are those that are causing the present agitation.

The question, then, that arises is: If these evacuations do

not receive the proper attention at the hands of the attendant, are they likely, after having gained access to sewage or water-courses, to cause a dissemination of the trouble?

Among the facts earliest demonstrated in connection with the organism of cholera was that it belonged to the group of bacteria known as facultative parasites, that is to say, it is an organism that is by nature parasitic; but which can exist for a time outside the body of a living host, and lead a saprophytic form of existence. Perhaps the first observation that conclusively settled this point was the finding by Koch, in a water-tank, at Sahab Bagan, Calcutta, on February 8, 1884, of living comma bacilli, which could be continuously demonstrated in this water up to the 23d of the same month. With this observation in hand, preparations were at once begun for determining accurately the conditions that favor the life and development of the organism in water, and though the results of these investigations are conspicuous for their lack of uniformity, they nevertheless demonstrate the possibility of this organism not only retaining its vitality but multiplying as well in the purest of natural waters; and, contrary to what would *a priori* have been supposed, its growth is not only not favored by gross pollution of the water, but when the contamination is excessive the effect is to shorten the length of time that the cholera spirillum may live in it. Among the first to take up this study was Koch himself, who states that in ordinary spring-water or well-water the organism of cholera retains its vitality for thirty days, whereas in the canal-water (sewage) of Berlin it died after six or seven days; but if this latter be mixed with fecal matters, the organism retains its vitality for but twenty-seven hours; and in the undiluted contents of cesspools it is impossible to demonstrate it after twelve hours. In the experiments of Nicati and Rietsch it retained its vitality in sterilized distilled water for twenty days; in Marseilles canal-water (sewage), for thirty-eight days; in sea-water, sixty-four days; in harbor-water, eighty-one days, and in bilge-water, thirty-two days.

In the experiments of Hochstetter, on the other hand, the

cholera spirilla in distilled water died in less than twenty-four hours in five of seven experiments; in one of the two remaining experiments they were alive after a day, and in the other after seven days.

In one experiment with the domestic water-supply of Berlin the organism retained its vitality for 267 days; in another for 382 days, notwithstanding the fact that many other organisms were present at the same time. There is no single ground upon which these variations can be explained, for they depend apparently upon a number of factors, which may act singly or together. For example, in general it may be said that the higher the temperature of the water in which these organisms are present, up to 20° C., the more active is their multiplication; the purer the water, that is, the poorer in organic matter, the more quickly do they die; whereas the richer it is in organic matter, up to a certain limit, the more rapid is their proliferation.

Still another point that must be considered in this connection is the antagonistic influences under which these organisms find themselves when placed in water containing organisms that are, so to speak, at home in water—the so-called normal water-bacteria; and Buchner has recently reported experiments to show that when suspended in fluids, and exposed to the direct action of the sun's rays, not only the cholera spirillum and the bacillus of typhoid fever, but other pathogenic organisms as well, are robbed of their vitality in a relatively short time. Pettenkofer and his associates have also recently recorded observations, not as yet, however, complete, that indicate a part played by higher water-plants in diminishing the number of bacteria that may have gained access to water in which they are growing.

Though considerable variation is seen in the results of these experiments, they, nevertheless, agree in the single point, viz., that the cholera organism can live, and does multiply, in natural waters; but there is no reason for believing that a single contamination of a watercourse used for drinking purposes, with a cholera or typhoid stool, is sufficient to cause a widespread

epidemic of the disease through the multiplication of the organisms added, and it is more than probable that, when such an outbreak occurs, it is due to continuous pollution by relatively large quantities of this material. As water is one of the elements essential to life that is ordinarily used in common by all the individuals composing a community, it is probably the agent most frequently concerned in the propagation of epidemic outbreaks of diseases of which Asiatic cholera and typhoid fever may be taken as types.

In very recent times we have heard a great deal about the part played by water in the dissemination of disease, and while what we have heard is, in the main, true, it is only partly true, and in consequence, the public, while awake to the possible danger from this source, does not, I fear, quite appreciate the point or points at which the greatest danger is to be anticipated. The result is that precautions are taken in one direction, and neglected in another of equal or more importance. To define more clearly at what I am driving: many individuals will say with confidence that they have no fear of cholera entering their household, and will give as a reason that only boiled water is drunk, but if the individual is asked if only boiled water is used in washing his green salads, or for rinsing his milk-jug, or if he is certain that boiled water is employed in the manipulation of the dairy from which he receives his milk supply, the probabilities are vastly in favor of his reply being in the negative. The danger is not alone in the drinking of waters polluted by disease-producing elements, but also, and probably to a greater extent, in the general use of such water about the household. A very vivid example of the part that polluted water may play in the production of diseases, even though it be not drunk, is the outbreak of typhoid fever in the Third Brandenburger Regiment, described by Gaffky. Every source of infection was excluded except a pump, the water of which was used in rinsing dishes, beer-mugs, etc. Investigation showed that the well of this pump was in direct connection through the soil with a privy-pit, a short distance away, into which the evacuations of a typhoid

patient had some time previously been thrown. As stated, the water from this pump was not used for drinking purposes, but was employed only about the scullery.

A relatively small amount of water used in the average household goes for drinking purposes, the most being used for kitchen and bath purposes, and of that employed in the kitchen a large amount is subjected to the disinfecting influence of heat. A certain proportion, however, greater than that used as drink, is not heated, but is employed for rinsing, diluting, etc., and in one way or another comes in contact with food-stuffs, some of which are rendered free from danger through cooking, while others come to the table in a raw state. The food-stuffs from which the greatest danger in this connection is to be feared are milk and salads that are used in an uncooked condition. The rinsing of a milk-jug with water consumes ordinarily far more water than the average individual takes at a draught, and if the water be but very slightly polluted with disease-producing organisms, the amount taken as drink may not be sufficient for the production of disease, but if a single pathogenic germ adheres to the sides of the vessel that has been cleansed for the reception of the milk, it rapidly multiplies into many thousands after the milk has been received. Unpleasant as this thought is, it is, nevertheless, one that we cannot ignore. Though only hot water may be employed in the kitchen, there is still the possibility that the milk supplied from the dairy may at the time of delivery be acting as a culture-medium for the organism against which efforts at home are being directed. This need not, of necessity, be due to dishonest dilution of the milk with water, but may arise from the water with which the milk cans were rinsed, and in this connection dairymen should under no circumstances ship their milk in cans that have not been thoroughly *scalded immediately before the milk is placed in them.* In times of epidemics of diseases of this character it is neither wise nor safe to use milk that has not been subjected to the action of heat, either by boiling or steaming, and though prejudice exists, particularly in this country, against the use of cooked milk, it is, nevertheless, our duty to recommend it.

Koch's experiments, and more recently those of Uffelmann, have demonstrated that the comma bacillus is not robbed of its vitality by freezing, and the investigations of Fränkel in Germany, and of Prudden in this country, have shown that natural ice may contain anywhere from a few hundred to several thousand bacteria per cubic centimetre. While the bulk of these bacteria are ordinary, innocent saprophytes, there is, nevertheless, a possibility of ice being a source of danger. I do not mean to discountenance the general use of ice, but rather the putting of natural ice *into* water to be drunk.

Still further, in this connection, is a consideration of domestic water-filters. While the results obtained by their use are desirable from an æsthetic standpoint, they nevertheless furnish a false sense of security. The best of them are reliable for only a few days, four or five at the most, and unless they are properly cleansed by scrubbing and "burning out", the condition of the water, from a bacteriological standpoint, after this period is far worse than that of the unfiltered water. When filters must be used, the water, to be absolutely safe, should be boiled *after* filtration and not *before*, as is often the practice.

As the danger against which we are to guard in cholera exists in the evacuations of afflicted individuals, it is manifest that by careful attention to these matters we have in our power the means *par excellence* for limiting its spread. A great deal is said and written as to disinfection and disinfectants, and just now the makers of these preparations are busy preparing for an active trade in the near future. Fortunately, the organism causing the disease is among the least resistant of any of the known pathogenic bacteria. It does not form spores; it is highly sensitive to the action of acids and alkalies; and is killed in five minutes when cultures of it are exposed to a temperature of 65° C. From this it is plain that it is easily within the reach of all those concerned in the treatment or care of cholera patients to render the evacuations of these patients entirely free from danger without the employment of complicated or uncertain processes.

The simplest and at the same time the most reliable disin-

fectants for the stools of cholera patients are chloride of lime, milk of lime, and boiling water. A one per cent. solution of good chloride of lime has been shown to destroy the cholera spirillum in feces in ten minutes. It should be made up as a two per cent. solution and added to the evacuations volume for volume. Milk of lime, ordinary fluid white-wash, when added to these evacuations until the entire mass reacts distinctly alkaline completely disinfects them in one hour. *Boiling hot* water added to these stools, in the proportion of three parts of the water to one of the evacuations, renders them free from danger in ten minutes.

When possible, the disinfection should take place as soon as the stool has been passed, but when this cannot be done, the vessel containing the evacuation or vomit should never be allowed to stand either inside the room or anywhere else uncovered. The reason for this is that flies are known to carry infection from these sources, and it is not improbable that food-stuffs have been infected through this agency. Uffelmann found living cholera spirilla upon a fly two hours after it had come in contact with a fluid culture of this organism.

There is still another point in connection with the dissemination of cholera, viz., the possibility of its being carried from one locality to another in clothing, baggage, and effects generally of persons who have themselves recovered from the disease, or who have been in places in which the malady was prevalent. Have we any experimental data that may serve to shed light upon this part of the subject? The experiments of Koch and of Kitasato are perhaps the most reliable.

When completely dried, according to Koch's experiments, cholera organisms do not retain their vitality longer than twenty-four hours, but by others their vitality is said to be destroyed by an absolute drying of three hours. In the moist condition, as in artificial cultures, their vitality can be retained for many months, though repeated observations lead us to believe that, under these circumstances, their virulence is diminished. According to Kitasato they retain their vitality when

smeared upon thin glass cover-slips and kept in the moist chamber for from eighty-five to one hundred days, and for as long as two hundred days when deposited upon bits of silk thread.

It is hardly probable that, as dried upon clothing, the drying is absolute, and we see from the experimental data that in this condition the organisms may retain their vitality for a sufficiently long time to again give rise to the disease when favorable conditions are present. Fortunately, as has been stated, the organism is markedly susceptible to the influence of heat, and it is therefore a matter of but little difficulty to render such clothing free from danger. For large quantities of clothing, as one finds in the effects of suspected immigrants, arrangements should be made for conducting the process of disinfection upon a large scale. Properly equipped steam disinfection chambers should be provided, and these should be under the management of individuals who have been taught the proper means of obtaining the best results from their employment.

In hospitals and in private families the same end can be obtained by the use of hot water. An ordinary wash-boiler, filled with boiling water, into which the soiled bed-clothing and underclothing can be placed *immediately that they are removed from the bed or patient*, not only serves the purpose, but serves it just as well as would a more elaborate apparatus.

The question concerning the disposal of the dead is one upon which some discussion has arisen, and as it is of no small importance, it might be of interest to see what experiment has taught us in this connection. In his experiments upon the destiny of pathogenic bacteria in the dead body, Von Esmarch was unable to detect later than five days after death living cholera spirilla in the body of a guinea-pig that had died of the experimental form of the disease; and as result of experiments performed in the Imperial Health Bureau at Berlin it was found that the bodies of guinea-pigs that had died of cholera induced by Koch's method of inoculation contained no living

cholera-spirilla when exhumed after having been buried for nineteen days in wooden boxes, or for twelve days in zinc boxes. In a few that had been buried in moist earth, without having been encased in boxes, when exhumed after two or three months, the results of examinations for cholera-spirilla were likewise negative.

There does not seem, therefore, to be any objection to the burial of the bodies, provided the interment does not take place in a locality where a spring or watercourse could be directly contaminated; indeed, on the contrary, this method of disposing of infected materials generally is second to cremation only in its requiring a longer time for the accomplishment of the same end.

PROTECTIVE INOCULATIONS. In this period of protective inoculation it is not surprising that efforts have been made to discover means of immunifying individuals against the possible infection of cholera by means of vaccination. Conspicuous in this field of research have been Gamaleia, Pfeiffer, Haffkine, and Klemperer, but thus far little has been done to prove protection for human beings. The experiments that have been made upon smaller animals have, in a number of instances, offered a favorable outlook, but the difficulties attending their successful employment upon human beings are, I think, too great to warrant the anticipation of their general adoption.

From what has been said we see that the difficulties attending the destruction of the infective agent of Asiatic cholera are by no means so great as those that stand in the way of preventing its invasion through the manifold portals that are open to it. In the first instance Nature does much in the way of limiting the life-period of this organism, but often by no means enough to admit of this limitation coming into play before a great deal of damage has been done. As to the part that we can take in this direction I shall limit myself to these fundamental precautions, viz., if cholera is not already in the household, much can be done to prevent its invasion by total abstinence from all uncooked food or drink; if cholera is present, we can rest with an easy conscience if each and every evacua-

tion, all vomited matters, and all soiled underclothing and bed-clothing are disinfected, by any of the methods recommended, as soon as they are passed or removed from the patient, for we shall then know that all has been done that can be done by us as individuals in preventing the spread of the disease to those not affected.

THE TREATMENT OF CHOLERA BY HYPODERMOCLYSIS AND ENTEROCLYSIS.

By JUDSON DALAND, M.D.,
PHILADELPHIA.

Gentlemen: My remarks this evening shall be confined entirely to the treatment of cholera after it has developed, and shall exclude all questions regarding quarantine and sanitation. Most of what I shall say is based upon my experience at the Swinburne Island Cholera Hospital, in New York Bay, where I was on duty during the fall of 1892. It is convenient, in discussing this question, to divide the treatment according to the stage of the disease, and we shall therefore speak of

1. The premonitory stage,
2. The evacuant or collapse stage, and
3. The stage of reaction.

In the way of prophylaxis but little need be said, as all are in accord with the statement that cholera is communicated from the sick to the well directly, and is usually swallowed. All, therefore, that is necessary in the way of prophylaxis is to prevent the swallowing of the cholera poison. This is best accomplished by avoiding ordinary water, and resorting to the exclusive use of distilled water, or carbonated water, or Apollinaris, or other table waters of like character, and also avoiding such foods as may be the carriers of the poison, more particularly partially cooked or uncooked vegetables, as well as fruits, salads, etc. When it is impossible to resort to distilled water or to bottled waters, ordinary water may be boiled and then used as soon as possible thereafter. Fruit and salads may have come in contact with the cholera germs, and, as they cannot be thoroughly

cleansed, it would be wiser to omit their use. All foods should be thoroughly cooked, as the comma bacillus is destroyed at a temperature of 212° F. In times of epidemic the most scrupulous care should be taken regarding personal cleanliness; the hands should be thoroughly scrubbed with hot water, and, if there is reason for believing that one has actually been in contact with the disease, the hands should be sterilized by dipping them in a 1 to 500 solution of bichloride of mercury. Great care should be taken to avoid attacks of indigestion, and all food taken should be nourishing and of easy digestibility.

1. *Premonitory stage.* The indications for the treatment of this stage, the diagnosis of which is difficult and often impossible without a biological examination of the gastric or intestinal discharges, are best met by placing the patient at rest in bed, and making sure that he is well protected from cold. His food should be of the simplest character, and preferably restricted to boiled milk, well-boiled rice, and milk toast, which should be given in rather small quantities at intervals of two hours. As the digestion, both gastric and intestinal, is usually performed with difficulty, the administration of five grains of pepsin with the food would be of benefit. Insomuch as the cholera poison cannot grow in acid media, and as acids tend to destroy the cholera bacillus, the administration of an acid is strongly indicated. As hydrochloric acid is the natural acid of the gastric juice, and as it promotes thorough digestion, it is preferable to all others that have been suggested, though doubtless they are all valuable. I would suggest for an adult 30 to 40 drops in a tumbler of water; for an adolescent from 20 to 30 drops, and for a child 10 drops, every two or four hours. Tannic acid has been suggested by Cantani, of Naples, but I believe all vegetable acids are inferior to hydrochloric acid. Our President, Dr. Roland G. Curtin,[1] some years ago obtained very valuable results in the prevention and treatment of cholera by the use of aromatic sulphuric acid in doses of twenty drops in four ounces of water, and he has succeeded in preventing the

[1] "Hydrocloric Acid as a Prophylactic in Cholera." Philadelphia Medical Times, July 12, 1873.

development of cholera in a large number of cases by its use during the epidemic of cholera in 1866 and 1867 while resident physician in the Insane Department of the Philadelphia Hospital.

In many cases it is impossible to recognize the premonitory stage, and perhaps in a majority of cases the physician has not the opportunity of seeing the patient until the stage of collapse has developed. I have observed several cases of Asiatic cholera in which this stage was absent, and in virulent cases quite uniformly the premonitory diarrhœa was slight, and often escaped observation.

2. *The evacuant or collapse stage.* In this stage much can be done. The indications for treatment are unusually clear, and the methods of meeting these indications are very plain. In consequence of the enormous discharge of liquids from the stomach and bowels the entire organism is shrivelled and shrunken, and the blood loses a large portion of its watery element. In consequence of this the red blood-corpuscles cannot circulate freely, and are, therefore, unable to pass to the lungs to take up their normal quantity of oxygen, nor to throw off carbonic acid. As a result, cyanosis shows itself quickly, and is more especially noted in the extremities and about the nose and lips. Furthermore, in consequence of the great loss of liquids, the muscles go into a tonic spasm; become hard and board-like in character, twisting and distorting the superior and inferior extremities, and inciting intense pain. To meet this indication it becomes necessary to administer liquids, but, unfortunately, vomiting and diarrhœa are constant, and attempts to administer liquids are usually followed by their prompt rejection. Attempts to administer liquids directly into the veins have been made, but in cholera all of the veins are collapsed, and are discovered with difficulty, and in many cases it is impossible to secure a vein of sufficient size for this purpose without proceeding to a formal operation for the exposing of those more deeply situated. This is particularly the case in children, and in this stage of cholera one does not feel justified in adding unnecessarily to the suffering of the patient. Moreover,

this method of meeting this indication has not fulfilled the brilliant results that were confidently expected, and has now been abandoned. The most natural and simple method of supplying this want of the system for liquids is by the subcutaneous injection of a solution of a $\frac{6}{10}$ per cent. (or two small teaspoonfuls) of sodium chloride in a quart of hot water, and sterilized, to which two ounces of brandy may be added. The operation of hypodermoclysis was first employed by Cantani, at Naples, during the epidemic in 1865, and was again used by him with great success in 1885. The operation was one of great simplicity, requiring for this purpose a small-sized aspirating needle and canula, which is attached to the rubber tube of an ordinary fountain syringe. The best point for the introduction of the needle is in the flanks between the ribs and the crest of the ileum; the inner surface of the thighs may also be used. Observation has shown that there is danger in the injection of liquids beneath the skin of the neck, as two cases of fatal œdema of the larynx following such injection have been reported. The operation should be performed in accordance with the well-known rules of antisepsis. The entire apparatus should be sterilized, and the skin that is about be punctured should be first washed in soap and water, then alcohol, then ether, and afterward well saturated with a 1 to 500 solution of bichloride of mercury. A fold of the skin should then be grasped between the thumb and forefinger and elevated, and the needle introduced through the skin into the subcutaneous space. When this operation is performed under these circumstances no unpleasant effects have been observed. In a large number of cases thus treated at the Swinburne Island Cholera Hospital but one abscess developed, which was distinctly traceable to an infraction of the rules here advised. The first injection in an adult would be one or two quarts; for an adolescent one or two pints, and for an infant one-half pint. The solution should have a temperature in the reservoir of 110° F., which will be reduced to 105° F. after traversing the long tube to the subcutaneous space. The liquid should be slowly introduced by hydrostatic pressure, which may be regulated to a nicety by

raising or lowering the reservoir. It requires twenty to thirty minutes to introduce one quart of liquid, and ordinarily it is unnecessary to disperse the liquid by massage, though this should be advised in grave cases, where rapid absorption is imperative. As many of you naturally suppose, this subcutaneous liquid forms a large oval-swelling, the size depending upon the amount introduced. In favorable cases absorption takes place in from twenty to forty-five minutes, but in some cases four hours are required. It therefore becomes evident that the rate of absorption is of great prognostic importance. If all the tissues are dried, and absorption takes place slowly, it is evidence that the lymphatic as well as the hæmic circulation is at a low ebb, and that death is imminent. Occasionally, when the operation is repeated frequently, the patient may complain of sensitiveness and pain, aggravated by light pressure over the region of the punctures, but this disappears within forty-eight hours. If, at the end of the first introduction, it is deemed desirable to introduce more liquid, a second puncture may be made in the flank at the corresponding point on the opposite side, and injections may be made every two hours, or less frequently, depending upon the condition of the patient.

The second indication for treatment is the pathological process going on in the intestinal mucous membrane, for, as is well known, the coma bacillus affects the superficial layers of this membrane, and are therefore peculiarly well situated for local treatment. The bacillus of cholera has not been found in the blood nor in the viscera, and the supposition is that they generate an alkaloidal poison, which, by its absorption, produces many of the symptoms of the disease.

Recognizing the difficulty of introducing any substances by the mouth in view of the frequent acts of vomiting that occur, and from the fact that, when vomiting is not present, it is usually excited so soon as attempts are made to introduce *any* substances, it is clear that we must abandon in most cases all hope of medicating the intestinal mucous membrane by the oral administration of drugs, though in cases where the stomach is retentive this may be attempted, and, under these circumstances, one

would naturally expect good results from one of the intestinal disinfectants, more particularly a substance like salol or the salicylate of sodium. Personally, I have had no experience in the use of remedies by the mouth in this stage of cholera, as in the cases under my observation the stomach was non-retentive.

Our efforts failing in this direction, one's attention is naturally directed toward a remedial agent that may be introduced through the rectum. Here, again, we are met with an obstacle in the anatomy of the ileo-cæcal valve which hinders the passage of liquids from the colon into the ileum. Prior to September, 1892, I was strong in the belief that the ileo-cæcal valve prevented absolutely the regurgitation of liquids from the colon into the ileum, and this has been the teaching of most of our well-known anatomists. Recognizing the importance of solving this question, the following experiments were made:

A fountain syringe containing three pints of water was suspended at an elevation of five feet, and a rectal tube introduced for a distance of six or seven inches.

Case I.—Male child, aged two years, dead of cholora. The liquid passed readily, filling the intestines and stomach.

Case II.—Male child, aged two years, dead of marasmus. Liquid passed freely, filling the intestine and stomach.

Case III.—Child, aged six years, dead of measles. The liquid passed readily through the entire intestinal tract, and flowed from the mouth and nose.

Case IV.—Child, aged three years, dead of measles. The liquid passed readily through the ileo-cæcal orifice, filling the small intestine.

Case V.—Child, aged three years, dead of measles. The liquid refused to pass.. A post-mortem examination showed that the colon was over-distended and that there was a twist in the ileum against which the distended colon pressed, rendering it impossible for liquid to pass into the ileum.

Case VI.—Female child, aged eighteen months, dead of measles. The liquid failed to pass both before and after opening the abdominal cavity. In this case the ileo-cæcal valve was small and the lips of the valve were in close apposition,

rendering it impossible for any liquid to pass from the colon into the small intestine.

Case VII.—Child, aged two years. The liquid refused to pass. Upon examination the ileo-cæcal valve was found to be competent.

These examinations show that in two cases the valve was competent to prevent irrigation of the small intestine, and in one case, owing to a peculiar twist in the ileum and the pressure of the over-distended colon, liquids fail to enter the ileum. This case is particularly instructive, and shows that in a certain number of cases success may be looked for, even though the first attempt prove a failure. In four cases there was no difficulty whatever in the passage of liquids from the anus to the stomach, or even out through the mouth and nose.

In addition to these facts, several of my patients to whom injections of tannic acid had been given vomited tannic acid, thus proving that the solution had passed through the ileo-cæcal orifice.

The feasibility of introducing liquids from the rectum into the small intestines having thus been proven, the next question that naturally arose was as to the character of the liquids and the method of application. Acting upon the fact that the coma bacillus is destroyed by acid, it is evident that this substance should be an acid; and, furthermore, this acid should be incapable of doing harm to the intestinal mucous membrane; a subject possessing astringent properties would also be of benefit, and further advantage would be secured by heating this liquid so as to supply warmth, as the temperature of cholera patients is usually subnormal. Of all the substances that have been advanced to meet these indications, tannic acid is, in my opinion, the best, and the solution that was habitually used in the treatment of the cholera cases in New York Bay was a 2 per cent. solution of tannic acid in water (or three teaspoonfuls to the pint) at a temperature of 110° F. Of this solution two quarts may be given to an adult, one to an adolescent, and one pint to a child. The solution should be introduced very slowly, and I should advise for this purpose the use of a medium-sized

soft rubber tube having a diameter of one-fourth of an inch. The one found most useful was originally intended for lavage. It should have one outlet one-half inch from the extremity, and a second on the opposite side two inches from the extremity, and the terminal portion should be closed so as to prevent a rounded extremity, which greatly facilitates its introduction. In an adult this tube should be thoroughly warmed, well oiled, and gently and slowly introduced into the rectum by a rotary movement and slight pressure for a distance of ten inches. Occasionally the first attempt will be unsuccessful, in which event the same procedure should be repeated, changing slightly the direction of the tube. To this soft rubber rectal tube should be attached an ordinary fountain syringe, which is the same as the one suggested for hypodermoclyses. The liquid in the reservoir should have a temperature of 110° F., which will be lowered 50° before it will have entered the small intestines. The advantages of this simple apparatus are that the hydrostatic pressure may be modified immediately to suit the particular case in question, and in this manner the rate of discharging the liquid may be regulated. It is absolutely necessary that the tannic acid solution should be *slowly* introduced, and ten minutes should be required for the introduction of one quart of this liquid. Three or four minutes should be allowed to elapse, while gentle pressure is made on the anus, and the patient should be encouraged to retain the injection, even though there be a strong desire to evacuate it. Not infrequently, if this desire is overcome, it will be retained without further difficulty. The tube should be slowly withdrawn. If the injection is retained it will inhibit the growth of the coma bacillus; it will supply heat to the body in the most advantageous manner possible, and if absorption takes place it will supply a much-needed fluid. If the liquid be rejected the first objects are obtained in part, and the intestinal tract is flushed of its contents, thereby removing poisonous material which, by absorption, would endanger life. In severe cases enteroclysis may be repeated as often as every four hours.

As *coldness* of the body and *lowering* of the *central tempera-*

ture is an almost constant condition in Asiatic cholera, it becomes necessary to supply heat. This has been accomplished by heating the liquids used in hypodermoclysis and enteroclysis, and also by the hot plunge bath, which should always be given to patients in this stage. This bath may be repeated as often as is deemed desirable, and I should further advise that the entire skin surface be covered by soft, woollen undergarments immediately thereafter, and from time to time hot air may be conducted beneath the bedclothing. Advantage may also be taken of hot air (not water-bags), hot sand-bags, or hot bricks, which may be placed near the body, more particularly about the extremities. The patient should be covered by two woollen blankets and a counterpane. A most excellent suggestion by which heat may be added to the body has been made by Dr. Francis X. Dercum—namely, that the patient be placed upon a water bed, which may be filled with hot water.

Stimulation. The best method of administering stimulants is by deep hypodermatic injections of brandy, repeated every hour, or less frequently, according to indications. For an adult 30 minims may be employed; for an adolescent, 15; and for an infant, 5 minims. During the stage of collapse, if at any time there is a tendency to vomiting, it is wise to avoid administering *any* substances by the mouth.

Lavage. As the stomach frequently contains large quantities of choleraic liquid, it is often advisable that a soft rubber stomach tube be introduced, and that lavage be thoroughly performed, using for this purpose a hot tannic-acid solution such as is employed in enteroclysis.

Nourishment—Liquids. The only nourishment that should be administered is peptonized or sterilized milk in small quantities, about two ounces every two hours. If this is not well received, it may be surcharged with carbolic acid gas, or koumiss may be substituted. Iced champagne in small quantities may also be given. The only liquid that should be permited is carbonated distilled water, or table waters, such as Apollinaris. Twenty to forty drops of hydrochloric acid may be administered with the carbonated water at intervals of four hours.

Drugs. In all the cases of cholera that I have treated no drugs have been employed other than those before mentioned. Particularly conspicuous is the omission of opium and of those drugs which have been universally advised in this disease. The only cases where drugs became necessary were those where intense pain was caused by muscular cramps, in which event to an adult was given morphia $\frac{1}{6}$ and atropia $\frac{1}{100}$ hypodermatically into the muscles affected. This common symptom of cholera was rarely met with in the cases treated by hypodermoclysis and enteroclysis, and this rarity is easily understood when it is remembered that the muscular symptoms are the result of the abstraction of liquids from the tissues of the body, so that when liquids are supplied this symptom rarely appears. The enormous list of remedies suggested, such as camphor, capsicum, chloroform, creosote, turpentine, amyl nitrite, arsenic, phosphorus, copper, lead, etc., I believe to be not only useless but harmful.

3. *Stage of Reaction.* During this stage the quantity of liquid food may be increased as well as the quantity of liquids. The hydrochloric acid should also be continued. If the suppression of urine, which is almost invariably present in the stage of collapse, continues, this would be an indication for the continuance of hypodermoclysis at intervals of eight hours. The enteroclysis should now be suspended. If the temperature is normal, artificial heat should be withdrawn, and if reactive fever shows itself the woollen undergarments should be removed and the patient should be covered with a very light-weight woollen blanket. In order to encourage more perfect digestion 5 grains of pepsin should be administered along with the hydrochloric acid. In favorable, uncomplicated cases the amount of nourishment may be gradually increased, passing from liquid food to more solid substances, such as boiled rice, bread saturated with milk, junket, poached *white* of egg, etc., gradually returning to ordinary food. In those cases where the typhoid stage of the patient remains the hypodermoclysis should be repeated once or twice daily, and, in addition to what has been suggested, $\frac{1}{40}$ grain of strychnine and 3 grains of

quinine may be administered every four hours along with the hydrochloric acid and pepsin.

DISCUSSION.

DR. SMITH: I ask the question whether it is not possible to give wide circulation to the practical suggestions of Dr. Abbott's paper. I think they should be brought before the public.

DR. BELL said he had listened with great interest to the paper of Dr. Abbott and the remarks of Dr. Shakespeare[1] on the prevention of cholera by treating the evacuations, when they are accessible, and by quarantine to prevent its introduction into the country; but during the while his mind had been more and more impressed with the thought that in the exercise of such efforts we are, after all, using the left arm only for defence, and very weakly at that, as compared with the greater strength of the right arm, to which Dr. Shakespeare alluded as the practice of England. While, he said, I have much confidence in quarantine as now understood, there is reason to fear that the too exclusive attention to it in this country recently is more calculated to increase the danger of the introduction of cholera among us than to lessen it. Sanitary officers as well as the public generally have had their attention diverted from the right arm of defence—local and general sanitation—and have been led to consider port sanitation as their chief dependence, instead of regarding it, as it is, a secondary means of defence. But we should not be misled by Dr. Shakespeare's reference to the thoroughness of local sanitation in England as her only defence. While it is true that, on account of its excellence, her people are better protected than any other people in the world, she is not unmindful of some danger from importation, and she is ever vigilant against its introduction at her own ports, even to the extent of refusing entrance to vessels and merchandise suspected of being infected, while—for the promotion of her commerce—she will clear them onward to the United States or other foreign ports.

With regard to the New York Quarantine in particular, however, if the question were less serious, Dr. Shakespeare's remarks would be amusing. It is quite true that the quarantine establishment of New York, which was undertaken on scientific principles a little more than twenty years ago, is still unfinished. But all of us here know that substantial progress in sanitary measures, similar to progress in military measures, is chiefly made when the enemy threatens. The foundation, as it now obtains, was laid under the spur of a threat-

[1] Dr. Shakespeare's article is not obtainable.—J. B. W.

ening epidemic. The epidemic retreated, and further State appropriations were refused. This has occurred several times during the interval. At the present time rapid progress is being made, and possibly, but I hope not, it may be completed before the enemy again retreats. But why should Dr. Shakespeare find so much fault with the intermittent efforts and incomplete defences of the port of New York in view of the utter deficiences of Philadelphia? Is Philadelphia in the admirable condition of London or other English ports? Is her right arm for defence so strong that she has no use for her left? It is sincerely to be wished that it were so, not with regard to Philadelphia only, but to every seaport and every city of the country; and quarantine would then give us less concern. But until that is so, until Congress can be made to realize that quarantine, whether national or otherwise, *is necessarily proportional with the neglect of local sanitation*, and by appropriate legislation relegates it to its proper place, by the establishment of a comprehensive health service adapted to the protection of health of the people throughout the country, instead of merely posting sentinels at the gates—until that time comes we must continue to support the sentinels, but *do not neglect home sanitation.*

One other feature apparently not thought of in the extended remarks that have been made with regard to our defective administration: We know that infected ships arrive with cargoes on board as well as passengers. The passengers are speedily removed and appropriately provided for, and so too, their personal effects. But it being deemed impracticable to disinfect the ship with cargo on board, she is simply "fumigated" and allowed to proceed to her dock, and her master is directed: "Now when you get your cargo out, be sure to thoroughly cleanse your ship before taking in other cargo or passengers on board." But the ship is never inspected by the sanitary officer before again receiving cargo or passengers, or before departure' or even inquiry made of the master whether he has complied with the directions given him by the health officer. The practice is that she proceeds to sea again *without* disinfection, and the result, an infected rounder arriving from time to time with infectious diseases on board, of whatever kind prevalent at her port of departure, on account of her continued filthy condition. If it is not smallpox or cholera, it is measles, diphtheria, or typhus. The *Siberia* is an example of such a ship. She seems prone to take along from her port of departure whatever epidemic then and there prevailing at the time. In short, she maintains a constant state of receptivity. She has recently been detained for smallpox. That we shall hear of her again before long, on account of the same or some other epidemic disease, is exceedingly probable. A still more constant danger to us is yellow-fever. I have before had occasion to designate a number of rounders with regard to this disease. The *ship* itself is, the most dangerous article of commerce, and the one which should be the most subject to sanitary vigilance.

Dr. Brannan: Dr. Shakespeare has said Philadelphia comes next to New York in the importance of its trade, but far behind it, and that is true, I don't know how much; but in New York it is enormous, on some days three or four thousand immigrants arrive, that was the case last summer; and as Dr. Bell says, it is only in times of threatened epidemics that there is any attempt to provide facilities to meet it. We are going through the same history again. At that time there was a very great demand for increased facilities, and work began, but was not completed. Now the principle work that is done is by the City Board of Health. They now have more money, and I think we will see good work.

Dr. Gihon: There is one matter in which we as physicians should especially interest ourselves. A suit for damages against the Hamburg-American Steamship Company is now being tried in New York, and among other things it has been shown that the surgeon of the ship deliberately certified that five deaths had occurred from disease of the heat or some malady of similar character, when that man knew the deaths had all been caused by cholera. I do not know how far our quarantine laws or regulations can hold such men responsible. It is, of course, true that their poorly-paid medical officers have no other alternative than deliberate falsehood or perjury to retain their places; but even this does not justify their moral cowardice in not refusing to certify to a falsehood. I know of another passenger steamship on board which fifteen deaths from heart disease, pneumonia, etc., were falsely reported by the medical officer. We cannot look to the medical officers of any of these ocean steamships for a single truthful statement, and, as physicians, it becomes our duty to take measures by which this disgraceful state of things may be remedied.

Dr. Shakespeare: As to the point of Dr. Gihon, the history of the movements of cholera by sea, is full of such examples of falsification of the ship's log, so far as sanitation is concerned, in order to avoid quarantine restrictions; and this is another objection I raised in the course of my remarks, the placing of too much credence upon the history of ships either as to inspection or disinfection on the other side, or the sanitary history while crossing the ocean, influencing the decision of the quarantine officer here in the face of an epidemic of cholera in Europe, passing the ship by without acting individually and solely for the people on this side, in seeing beyond peradventure no infection shall come by way of baggage or in other ways. The danger and weakness of the national law is undertaking to supersede the quarantine on the other side with disinfection for what should be done here. If there is any value in establishing an outer line of defences, it is mainly to act as a line of pickets, giving warning to the main line of defence, where the actual test should take place.

NOTES ON TUBERCULOUS PLEURISY.

By JOHN H. MUSSER, M.D.,
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Case I.—In the fall of 1890 I was asked to see W. A., the brother of a physician, who was said to be seriously ill. I found a tall, spare man of five and thirty, extremely weak, suffering from chest pain, dyspnœa, and severe paroxysmal cough. Both symptoms caused sleeplessness and great prostration. The cough was most harassing, was spasmodic, and mostly unproductive. A mucous expectoration alone was discharged at times. The dyspnœa was extreme, the respiration, 30 per minute when at rest, would increase to 50 and 60. But little need be said of chest pain. It was so severe as to require constant attention in order that relief might be secured. With the lung symptoms there were fever and sweats. The fever ranged irregularly from 99° F. to 104° F. in twenty-four hours. It was further noted that the appetite was lost, the tongue heavily coated, and the bowels relaxed.

On physical examination the left apex, both anteriorly and posteriorly, was found scarcely to move in inspiration ; in the former position immobility reached down to the third rib. The fremitus was absent, the area dull on percussion, the breath sounds absent, except at the spine of the scapula ; over the base a distant bronchial breathing could be heard. The right side was contracted, the base anteriorly retracted, and the expansion much lessened. Dulness and absent breath sounds were noted.

The heart was displaced to the left. The physical condition seemed to be due to a greatly-thickened pleura, which capped

the left lung, and to pleural thickening and old adhesions at the right base. The patient had had three attacks of pleurisy; his family were predisposed to tuberculosis, and the patient was exposed to infection. Careful attention to diet, and treatment of the gastric catarrh, respiratory stimulants (strychnine), strapping the chest to relieve pain, with quinine by the rectum, aided the man in recuperation. Subsequently, respiratory gymnastics, tonics, and an out-door life brought him in condition to return to business. When last seen by me the parenchyma of the lung had apparently not been invaded. [Patient in active business at present—1894.]

The above scantily recorded case represents an extreme type of pleurisy which is of tubercular origin. The family history, the occurrence of repeated attacks of pleurisy, the occurrence of cough, pain, and dyspnœa as previously indicated, with some emaciation, point very strongly to tuberculous pleural infection. The fever and sweats are characteristic phenomena of the tuberculous process.

It would scarcely be credible that large thickenings of the pleura could develop were we not familiar with the findings of post-mortem examinations. Frequently great masses are seen. The writer recalls one case in which masses four and five inches thick surrounded the compressed and collapsed lung, which was free from disease. Some fluid filled up the greatly shrunken pleural cavity. Practically, the man lived with one lung. Correct conclusions as to the physical condition of the lungs arose particularly from the prominence of the facts derived by inspection and palpation—retraction, lessened movement, and lessened fremitus with absent breath sounds, and decisive symptoms which would occur in cases in which fluid or inflammatory exudations are interposed between the thoracic wall and lungs.

Case II.—The patient was a farmer's wife in Lancaster County, aged forty-five, who had borne two children, and had attended to the exacting duties incident to her husband's occupation. She was exposed to infection at about twenty-five. After this period she was in impaired health, and under weight without cause, or at least without known cause, for the reason

that trouble had not been taken to ascertain the cause. Finally, after a season of care she took to bed. She lost more flesh, had fever, and some sweats, cough racked her, and there was dyspnœa on exertion. The illness continued over several months. If the weather was inclement she would keep to her bed; generally she would rise for two or three hours each day. When seen by the writer she had cough which kept her awake, dyspnœa, and chest pain. The physical signs of thickened pleura were found at apex anteriorly, and over the scapular region of the right lung. The patient was emaciated to a moderate degree, listless, and worn from cough. She gradually improved, and as spring advanced went out, and is now fairly well, although not able to take on excessive and unusual labors.

Case III.—A woman, seamstress, aged twenty-five, was ill two months with unilateral pleural effusion, which was aspirated. She did not improve, had a mild fever, was growing weaker; an effusion on the opposite side was found. After a long illness (two months) she fully recovered, and now, six years hence, is conducting her occupation.

Case IV.—An Irish laborer, aged forty, prematurely aged in appearance, was admitted to my ward in the Philadelphia Hospital with bilateral pleural effusion, detected by the usual physical signs and by aspiration. There was no dislocation of the heart. Cough, dyspnœa, and chest pains were the most pronounced symptoms. There was much mucous expectoration, which never contained bacilli. The dyspnœa occurred in paroxysms as well as being constant. When admitted the temperature was about 102° in the evenings and 100° in the mornings. After a week in bed it fell to normal. The patient was much emaciated. The fluid aspirated was bloody and contained bacilli, and when guinea-pigs were inoculated tuberculosis was set up.

The patient remained under observation all winter. The effusion gradually lessened, and the weight and strength improved. The cough and expectoration subsided, but dyspnœa on exertion lingered a long while. The physical signs of thickened pleura remained at the bases, but no contraction of

the chest or dislocation of the heart was observed on the last examination.

Case V.—The patient was sixty years old and has had a hard life. He had one testicle removed by Prof. Ashhurst in 1885, and the second at the Episcopal Hospital in 1887, because of tuberculous disease. He improved, but did not recover full health. He had been under observation the past three years in the Philadelphia Hospital. Cough and dyspnœa harassed him. The latter symptom was most marked. He was under weight and feeble, but did not have fever. The anterior portion of the left thorax was contracted, behind it was unduly prominent. A thickened pleura with absent breath sounds and without fluid extended from the third rib to the margin in front, and from the middle of the scapula to base behind. Absent movement and fremitus with flattening and progressive retraction were noted. There was no history of acute pleurisy; the progress was gradual: after being under observation two years infection of the right lung took place. Latterly the tuberculosis became general, and death was caused by infection of the cerebral meninges.

Case VI.—The patient, an Irishman, aged thirty, who has had attacks of pleurisy, is in the wards of the Philadelphia Hospital. He is under weight, and, although able to assist in light hospital duties, has some cough and much dyspnœa. The left lower three-fourths of chest is retracted in front, bulging behind. It is non-expansive and fremitus is absent. Dullness is marked. Apex of heart is not detected. The apex of the right lung is the seat of commencing tuberculosis. In the second and third interspace of left lung there is low-pitched bronchial breathing. At the extreme apex of the same there is harsh breathing. The sputum contains bacilli but no elastic fibres. With the exception of the apex behind, the whole left lung is useless, and apparently being gradually closed in the grasp of contracting tuberculous exudation.

The above series of cases represent various types of cases familiar to all of you. Other examples could be given of different location, mode of progress, and type.

Mode of Onset. It is thus seen that the disease may develop in several ways.

1. It may develop acutely or by a series of acute attacks, eventuating in chronic chest deformity, poor health, and persistent dyspnœa with occasional cough.

2. Acute pleurisy with effusion may occur; often the accumulation may be bilateral. The same prolonged impairment of health, emaciation, and dyspnœa will be found. Chest deformity will not be so marked, but the respiratory capacity is lessened.

3. It may develop insidiously, as in the case that arose secondarily to genital tuberculosis.

Diagnosis. We note in most instances that the patients are adults, over thirty; that they are under weight; that they are unable fully to meet the requirements of an active life; that they have periods of poor health, during which exacerbations of fever, cough and dyspnœa occur; that dry painful cough and dyspnœa are the most marked pulmonary symptoms.

General and pulmonic symptoms point to the condition. Emaciation is the most marked of the former. It is not extreme. It is seen in the gaunt subjects in the middle period of life who have chronic cough, and are often laid up with pleuritic attacks. The patients are from ten to twenty pounds under weight. They are somewhat anæmic. If compelled to remain in-doors it is more marked. The lips are blue. The patients are sensitive to cold and dampness. The latter excites pleuritic pains. Gastro-intestinal catarrh is common. The patients are then sallow and have bilious attacks.

Of pulmonary symptoms, unproductive *cough* is the most harassing. The cough is readily excited by faucial or other irritations. It is dry and spasmodic; repeated efforts may result in the expectoration of a small amount of clear mucus. The expectoration does not contain bacilli. *Dyspnœa* is present to a greater or less degree. It is excited upon unusual exertion. It is not asthmatic in character, and does not interfere with sleep. The latter is always secured if cough or chest pain is not troublesome.

Pain. The pain may be more or less constant. It is then oppressive in character, and like a constriction or indrawing. It is associated with much chest deformity, dislocation of organs, and dyspnœa. Acute pain follows "cold," exposure, or over-exertion. It is the familiar oft-recurring "stitch" that patients are affected with from time to time. While the general and local symptoms point to the true nature of the case, the *physical signs* are of the utmost value. They are elicited by the usual methods, but stress must be laid upon the importance of inspection and palpation. Without resorting to these methods, unfortunately too infrequently done, the diagnosis cannot be established fully. Indeed, the disease is overlooked, I am fully convinced, because inspection and palpation are not resorted to.

Examination of Serous Exudations. The result of such examination is rarely satisfactory. In one case only were bacilli found in the serous exudate out of many in which they were sought for.

Infection. I am fully convinced, however, that in cases of the above symptom-group we are justified in laying much stress upon a history of exposure to infection. If, with such symptoms, exposure is demonstrated, the diagnosis is pretty well established. Primary infection of other organs in a patient with such symptoms renders a diagnosis almost final.

Tuberculous pleurlsy is distinguished from pulmonary tuberculosis by the large extent of signs of pleuro-pulmonic invasion, in comparison with the general symptoms, by the age, by the absence of extreme hectic and extreme emaciation, by the difference in the character of the sputum, by the absence of bacilli, by the unproductive cough, the extreme chest pain, and the chest deformity. The middle or basic portions of the lung are most frequently affected.

Course and Termination. 1. After an illness of three months or more, with or without effusion, a cure may be fully established. We must not be deluded into believing that reinfection either of the pleura or the lungs will not take place because full health, weight, and strength are restored. The cases of acute pleurisy which afterwards become tuberculous

are of this class, of which many examples might be given. 2. Other cases do not get well, but remain stationary with five conditions—impaired strength, reduced weight, shortness of breath on exertion, more or less cough, and gradual chest deformity. 3. General infection may take place. 4. The lungs may be invaded, and the pulmonary type overtop the pleuritic. Infection remote from the primary pleuritic attack may take place. One patient, aged fifty-four, had a long winter's bout with pleurisy with effusion. Three years afterward tuberculous caries of the vertebræ developed. Another, exposed by nursing her son, had apical pleurisy. The third rib became carious, and, although it was excised by Agnew, the vertebræ became carious, and now bone tuberculosis is at its height. 5. The peritoneum may be infected, particularly the sub-diaphragmatic peritoneum, with hepatic and splenic tuberculosis. It must not be forgotten that in many chronic cases of primary tuberculosis the major lesion is in the pleura, thereby preventing the rapid decline otherwise expected from the apparent excess of lesion as the physical signs would appear to indicate. Moreover, out of this type comes a large portion of the group of cases of fibroid phthisis.

Prognosis. It is always cheering to make out a tuberculous pleurisy when in the midst of much pulmonary tuberculosis. First, the probability of a cure is very much greater than in other forms of tuberculosis. Second, a partial cure can be promised in many cases. Then the progress is slow, and hence the duration of life much greater than in pulmonary tuberculosis. The symptoms of the terminal stage are, however, more distressing. The dyspnœa, the breast pang and chest constriction, the internal suggestions of dragging or pulling, as upon organs, are agonizing to witness. The harassing cough is most weakening to the patient. Tuberculous peritonitis, of sluggish type, adds to the severity of the terminal symptoms.

DISCUSSION.

Dr. Bowditch: There are one or two important points as to the prognosis of tuberculous pleurisy. Some of the members of the Society may remember that I read in Boston four years ago the results of 97 cases of pleurisy, occurring in thirty years, from 1848 to 1878, in my father's practice. I looked up the records and wrote to some 200 of them, and I received answers from 97. I cannot here detail the figures, but about 60 per cent. of those had recovered entirely from the pleuritic trouble, and in those who had died the cause of death was non-tubercular in character. This would rather go against the very gloomy prognosis made by Landouzy, who gave the idea that all pleurisies were tubercular in nature, and that probably phthisis would sooner or later develop. One case I remember especially, who twelve years before I wrote, had had a double pleuritic effusion. When I examined that man twelve years after the operation of thoracentesis he was a picture of perfect health, the respiration and percussion were normal on both sides, without any sign of tuberculous trouble. If phthisis should develop in that case, we should have no right to maintain absolutely that it was in consequence of the pleurisy before.

Dr. Wilson: I think that the communication of Dr. Musser is very interesting and of practical importance. It has taken the profession a long time to recognize the fact that the greater number of pleurisies with effusion are tuberculous in nature. We now begin to recognize that a great number of plastic pleurisies are also of tuberculous origin; but the prognosis is very far from hopeless because they are so. We recognize in the histological changes which take place as the result of resorption of a pleural effusion, or of the evacuation of the pleural cavity, and the subsequent inflammatory changes, one of the methods by which a cure of tubercle in serous membrane is brought about. The profession is now learning that most of the cases, or a large proportion of the cases, of chronic pleurisy are also of tuberculous origin. Probably no authority expressed in opposition to this view has been more important than that of Clarke, who reported some years ago a series of cases, which he classed as non-tuberculous chronic pleurisy. In looking over that list it will be seen that several of the cases developed tuberculosis of the lung itself.

It has been assumed that such cases are not of tuberculous origin, because tubercle bacillus are not found in the sputum, and in cases in which there is effusion, the presence of bacilli cannot be demonstrated. But we know perfectly well that by the ordinary methods of staining and microscopical examination, tubercle bacilli are not

usually found in effusions of tuberculous origin, and we know that many of these apparently sterile effusions are capable of producing tuberculosis upon inoculation of the peritoneum of the rabbit. The history of such chronic pleurisies proves them in a large proportion of the cases to be of tuberculous origin.

Another important point to which Dr. Musser evidently attached much importance, and which fully coincides with my experience, we are too much in the habit of depending upon auscultation and percussion as the leading methods of diagnosis. I believe that in many cases where auscultation and percussion fail to give us conclusive signs, the method of examination by inspection, under the different conditions of respiratory movement, and that of palpation, will yield results which are astonishing, signs which are most satisfactory and definite, where other more elaborate and popular methods have failed. It is my habit, when the opportunity has arisen, to call the attention of my students to the value of the method of palpation, and more particularly of inspection in the examination of the chest, and not to underrate these methods in comparison with percussion and auscultation.

Dr. Anders: I was much interested in the paper of Dr. Musser. I will call attention to but one or two points, which seems to me to be of considerable importance. First, the question of prognosis in these cases. I agree thoroughly with the gentleman who preceded me, that the prognosis is more favorable than when we have tuberculous disease of the lungs. The point was brought out that in the very young the prognosis is better than later in life. And this is more particularly true of the tuberculous pleurisies than of other localized forms of this affection. It has been my fortunate opportunity to see a larger number of cases of pleurisy in children, and not in a single instance, when not secondary in nature, have they resulted in fatal tuberculosis. These cases may be classified, I think, into those which are primary and those which are secondary. Some contend that cases of primary pleurisy are frequently met with. I do not believe this, and chiefly for the reason that the more carefully I investigate the sputum and chest of patients suffering from pleurisy, more particularly when of the chronic variety, the more frequently do I find evidences of associated disease of the lungs, lymph glands, or other organs. I, however, do not deny that tuberculous pleurisy is rarely primary.

CARDIAC DYSPNŒA.

By ALFRED LEE LOOMIS, M.D.,
NEW YORK.

Six years ago I read a paper before the New York State Medical Society on "Paroxysmal Dyspnœa in Certain Forms of Heart-disease." I desire at this time to modify some statements then made, and to add some recent observations on this subject. On an etiological basis, dyspnœa may be divided into four varieties. If it arises from obstructions in the larynx, it may be designated *laryngeal dyspnœa;* if the obstruction is in the bronchial tubes, *bronchial dyspnœa;* if in the structure of the lungs, *pulmonic dpspnœa;* if from arrest in the passage of blood through the heart to the lungs, *cardiac dyspnœa.*

In very many of those valvular diseases of the heart, which are accompanied by hypertrophy and secondary dilatation, dyspnœa is a prominent symptom. Under such circumstances, however, the dyspnœa is of gradual development, is often, and indeed usually, more or less persistent, and depends rather upon the secondary pulmonary changes than directly upon the cardiac lesion.

In the form of dyspnœa which I now propose to consider, the difficulty of breathing is due entirely to a cardiac condition, which allows of temporary slowing or permanent arrest of the blood-current in the heart. In this condition there are no organic changes within the lungs, bronchial tubes, or larynx to obstruct the entrance of air to the alveolar surfaces. Under whatever cardiac condition this form of dyspnœa may arise, it has this one essential cause—viz., a temporary or permanent arrest of the blood in the heart, a condition which evidently

must be only temporary or speedily terminate in death. When distinct valvular changes are present with consequent hypertrophy and secondary dilatation, a gradually-developing chain of symptoms precede and give warning of the approach of the more serious conditions. But when, on the contrary, the entire history is one which does not direct attention to the heart, and when even a physical examination shows few if any signs of cardiac disease, it is quite possible, and it often happens, that the exact nature of the case is not detected or the changes which attend it fully appreciated. It is just because it is so commonly the result of obscure changes in the arteries and cardiac walls rather than to valvular lesions of the heart that I wish to emphasize its importance, and invite attention to its more complete study.

Often when there have been severe attacks of cardiac dyspnœa during life, with no appreciable physical signs of disease in the chest, or any evidence of arterial or renal disease to account for their occurrence, the autopsy will reveal advanced fatty or fibroid changes in the cardiac walls, with dilatation of the heart-cavities, and there will be found in the ventricular cavities, especially in the right, large exsanguinated clots, which are so interlaced with the chordæ tendineæ of the tricuspid valve as evidently to interfere with the blood-current through the heart during the last few hours or, perhaps, days of life. Occasionally the heart-cavities will be found distended with blood in diastole, when more or less complete obstruction of the coronary arteries will be the only lesions to account for the sudden death.

From recent and more extended studies I am led to the belief that these dyspnœic attacks rarely terminate fatally, even when extensive degeneration of the heart-walls exists, unless associated with *arterial* changes, especially in the walls of the aorta; and I am more and more of the opinion that the mild as well as the severe anginal attacks which we are accustomed to attribute to heart-failure depend rather on the aortic changes than on the cardiac, although we usually find the two conditions associated at the autopsy. In two instances where

an attack of dyspnœa terminated fatally, the autopsy revealed obstruction of the coronary arteries as the only cause of death.

When extensive cardio-vascular changes exist the attacks of dyspnœa may be brought on by very slight exciting causes, and may be repeated frequently before a fatal result is reached. In such cases some new obstacle is usually found within the heart-cavities to obstruct the passage of blood, and to so embarrass the already feeble heart that it cannot recover itself. A frequent cause of death under such circumstances is the formation of exsanguinated fibrinous masses which become entwined around the chordæ tendineæ of the tricuspid or mitral valve. It seems probable in such cases that during the stasis of blood in the ventricles, which results from their imperfect and feeble contraction at the commencement of an attack, cordiac thrombi are formed, and as the heart partially recovers itself the filaments of fibrin become separated and interlace themselves with the chordæ tendineæ. The curtains of the valves are thus held in the valvular opening, and there results a complete arrest of the blood-current through the heart, which causes sudden death. In a few instances I have found both the right auricle and the right ventricle filled with exsanguinated coagula, which sent prolongations into the pulmonary artery and obstructed the blood-current to the lungs. I have a specimen where death occurred suddenly on the third day of an acute lobar pneumonia, in which a thrombus entirely filled the cavities of the right auricle and ventricle, the heart being in other respects healthy. In every case of cardiac dyspnœa terminating in death which has come under my observation, and where I could obtain an autopsy, there was unmistakable evidence of a mechanical arrest of the circulation in the heart, either from failure of its contractile powers or from obstruction of blood in its passage through the heart by fibrinous masses in its cavities. Usually the arrest is in the right heart, and as a result the blood is shut off from the pulmonary artery. The lungs under such circumstances will be not only free from congestion but more or less bloodless, while the other internal organs will be found intensely congested.

If the obstruction is in the left heart, the blood-current will be arrested in its passage to the aorta; then the lungs will be intensely engorged, and the other internal organs will contain less than their normal amount of blood.

It seems to me reasonable to assert that the primary or predisposing cause in all cases of true cardiac dyspnœa is a gradual failure in the contractile power of the heart—a failure of the mechanical force of the circulation; the exciting cause of the dyspnœic attack is anything which causes the heart failure to reach such a point as practically or completely to arrest the cardiac circulation. Thus, when all the necessary factors exist, mental shock, excessive physical exertion, violent passion, or sudden fear may act as the excitant to the attack of dyspnœa. These excitants may differ widely from each other, for a feeble heart may be stopped as readily by a call for stronger action, which it is not prepared to meet, as by suddenly cutting off its blood-supply or obstructing its nutritive vessels. During the relaxation of the physical forces which comes in the early hours of the morning after profound sleep, when the heart in perfect health has its minimim propelling power, is the period in the twenty-four hours when the dyspnœic attacks are most likely to occur. Often subjects will awake about four in the morning in the midst of a severe attack of dyspnœa.

A stomach distended from flatulency or any other cause produces in a healthy person little inconvenience beyond a sense of fulness or slight pain; but, when a distended stomach presses on the diaphragm in one with cardio-vascular disease, the inspiratory movements become impeded, the pulmonary circulation is embarrassed, and the enfeebled heart enters on a struggle for which it has no reserve power, and a more or less severe dyspnœa is the result. A fully-developed attack usually comes on with a sense of constriction across the chest, which is immediately followed by a gasping for breath, accompanied by spasmodic contractions of the respiratory muscles. The surface of the body becomes pale and cold, the countenance extremely anxious, and the patient, if the attack is not too severe, is constantly changing his position with the hope of

obtaining relief. Painful muscular spasms often occur in the voluntary muscles in different parts of the body. The mind remains clear, the pulse becomes feeble, irregular, and intermittent, and frequently there will be a prolonged absence of the radial impulse. This form of cardiac dyspnœa presents a peculiarity in the relation of pulse to respiration as distinguished from all other forms of difficult breathing—*i. e.*, that the return of the pulse precedes instead of follows the subsidence of the dyspnœa.

The symptoms which precede an attack, or what may be called its preliminary symptoms, are few, but they are diagnostic. One of the earliest and most constant, and one which may exist for months, perhaps years, before the occurrence of a fully-developed attack, is an occasional sinking or exhausted sensation in the præcordial region. This sensation will come on from very slight causes, such as sudden physical exertion or strong mental emotion. At first a diffusible stimulant, a few swallows of hot water, or the recumbent posture will relieve it. In some instances the patient will complain of a choking sensation, commencing in the cardiac region and passing rapidly to the pharynx, which comes on immediately after taking food, or at the moment of falling asleep, when it is often very oppressive, and, to nervous subjects, alarming. So-called dyspeptic symptoms often accompany it: sooner or later there will be established an irregularity in the cerebral circulation, indicated by attacks of vertigo, headache, hissing sounds in the ears, and occasional dimness of sight. For a long time these symptoms may cause the patient no serious inconvenience, but eventually a series of obscure nervous phenomena will develop; he will become irritable, melancholic, and perhaps hypochondriacal, and he will very likely be treated for neurasthenia, or perhaps congestion at the base of the brain. At length, attacks of faintness with pallor will occur, and the patient will be troubled with insomnia, his mental faculties will be disturbed, and slight physical exertion, such as going up-stairs, will cause breathlessness. In one who presents these symptoms an attack of cardiac dyspnœa is liable to occur at any moment.

The physical signs, if the general symptoms are well marked, are usually distinctive: the cardiac impulse is feeble and difficult to locate; there is usually an epigastric tremor; the heart-action is irregular in force and rhythm although the patient may not be conscious of its irregularity. The first sound of the heart is short and valvular in character, and during periods of great cardiac irregularity it is difficult to distinguish the first from the second sound. In the majority of cases there are no cardiac murmurs, and no evidence of valvular insufficiency. There will be an entire absence of any pulmonary or laryngeal changes sufficient to produce the general symptoms, and an examination of the urine will usually give negative results.

These patients become exceedingly anxious about themselves, and will consult one physician after another without obtaining more than temporary relief, until a severe attack of dyspnœa occurs, when little can be done to avert a fatal issue.

DISCUSSION.

Dr. Levick: I have listened with a great deal of interest to this paper. I am inclined to think that heart clot forms during life much more frequently than is generally supposed. In a case under my care in which this had occurred the patient lived four months and had frequent recurrences of severe dyspnœa. After death a very firm old clot was found in the chordæ tendineæ. I believe I have seen other cases in which this has happened.

Dr. Jacobi: In two of the cases Dr. Loomis has detailed, he has been able to tell us about the condition of the heart. That it is the original condition of the heart that must be accused and not the presence of the thrombus, be it ever so old, that gives rise to the original symptoms appears clear to me. It is true, after the thrombi have been formed the symptoms are worse; but the thrombi must be explained by the fact, which preceded them. In one or two of the cases he found fatty change of the right heart, and that is a sufficient explanation of all the symptoms. In another case he found that the coronary artery had been obstructed for some time, another bloodvessel had been obstructed of late, and that means additional starvation of the heart, ill nutrition, over a long time, over the same time at least that the coronary artery had been obstructed.

There are two conditions in two different cases, local fatty degeneration, and in another ill nutrition of the whole heart muscle at fault. That brings me to the conclusion many of us have come to long ago, and which I think is uppermost in the mind of Dr. Loomis, that in a large number of cases of heart trouble we do not have to deal with endocardial and valvular changes, but those of the heart muscle. Most of us have been taught to look for valvular changes, and those almost exclusively. We ought to remember that the heart muscle is constantly at work, both under favorable and unfavorable circumstances. Unfavorable circumstances are, for instance, over exertion, mental emotions, infectious diseases of puberty and adult life, the presence of diphtheria, scarlatina, typhoid fever, these will give rise to physical changes in the heart muscle, which will not always disappear, on the contrary, the heart after such diseases is apt not to recover entirely. Such conditions and changes in the heart muscle which result from over-work or are influenced by infectious disease are very common and must be considered when such dyspnœa occurs in middle life. The changes which take place in older life when atheromatous alterations have taken place can be explained by these; but in earlier years when atheromatous changes have not developed, we have to deal with the fact that we have changes in the heart muscle resulting from previous cause, whether clot due to chronic carditis or not makes no difference; but we do find changes in the muscle.

Dr. Loomis: I do not think I was fully understood in regard to the effects of the exsanguinated clots in the cardiac cavities. These patients get on fairly well until something slows the heart's action, which allows stasis to occur in the heart cavities and clots are formed, the occurrence of those clots causes the final arrest of the blood current in the heart. Coagulation of blood in the heart cavities so long as the heart's muscle retains its normal integrity is impossible. It is the loss of this integrity which allows the clots to form and thus arrest the blood current.

Clinical observers have been studying too much valvular changes in the heart and too little changes in the cardiac walls and cavities. I do not fear so much those hearts that have the loudest murmurs as those which have no murmurs and give evidence of extensive changes in the walls and cavities of the heart, especially in persons in middle life, those are the cases which die suddenly and unexpectedly.

A MECHANICAL DEVICE FOR ILLUSTRATING THE MOVEMENTS OF THE LUNG IN PENETRATING WOUNDS OF THE CHEST.

By ANDREW H. SMITH, M.D.,
NEW YORK.

The apparatus consists of two bellows, operated by a handle common to both, representing the thoracic cavities, and each containing an elastic bag representing the lung.[1] The top of each bellows is of glass. A slot on each side, covered by a slide, represents a wound of dimensions variable at pleasure. Tubes representing the bronchi and trachea connect the two bags. With the slot of one side wide open and the bag on that side disconnected from its fellow, it is seen that the movements of the bellows are without effect upon the bag. But when the connection is re-established, it is evident that the bag receives air from its fellow when the handle is depressed, and that it collapses when the handle is lifted, its movements being exactly the reverse of those of the bag on the other side. When the device representing the glottis is partly closed, this reverse movement is very marked.

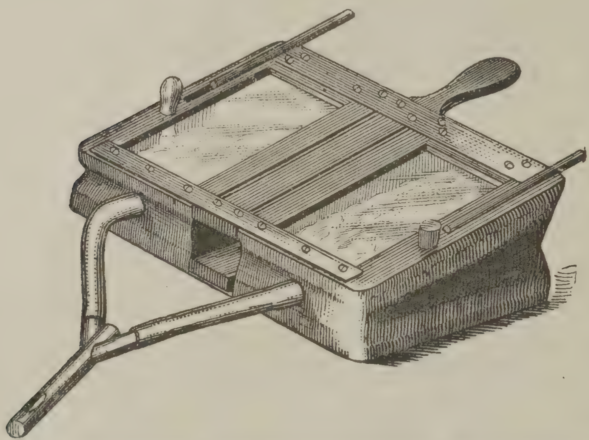
It will be observed that this action exactly resembles that seen in an animal when the thorax on one side is freely opened.

On progressively lessening the size of the opening, this reverse action becomes constantly less until a point is reached at which the lung (bag) remains at rest in a state of partial inflation. With a still smaller opening the lung begins to

[1] The apparatus was shown at the American Climatological Association, Philadelphia, May 26, 1893.

follow the movements of the chest and becomes more and more independent of the action of its fellow.

The accompanying cut will perhaps best illustrate the form of apparatus employed.



Dr. A. H. Smith's device for illustrating the movements of the lung in penetrating wounds of the chest.

This transference of air from the lung on the sound side to its disabled fellow may be turned to account in expanding the compressed lung when a permanent opening has been made into the cavity of the chest in a case of empyema. It is necessary only that the patient, after a full inspiration, compress the nostrils and make an expiratory effort. He can graduate the distending force exerted upon the compressed lung by his sensation of pain, ceasing the effort when the discomfort becomes considerable. Frequent repetitions of this from day to day will greatly hasten expansions, especially when there are adhesions present.

I would also suggest the use of a valvular drainage-tube for cases of operation for empyema. The valve may consist simply of an India-rubber nipple with a slit in the top. This nipple is secured to the outer extremity of the ordinary tube, and forms a complete valve.

DISCUSSION.

Dr. Jacobi: This is a very instructive demonstration; and I request Dr. Smith to go at it again to explain the following: I am positive when you open the chest wall for empyema and there are adhesions between the two pleura, the lung follows as long as there is movement of the chest. In all cases in which there are no adhesions—from this I should suppose that the lung would collapse on inspiration, but it does not, and I request the Doctor to give that full explanation. If the lung is compressed only by the pus, it will follow the respiratory movements on inspiration and expiration, as is seen by the pus welling out. Why is it that it should be so? This demonstration is very beautiful and surprising.

Dr. Smith: Do you mean when you first perform the operation and look into the wound you see the lung expand?

Dr. Jacobi: You see the pus welling out.

Dr. Smith: You see it in expiration, I think, and in expiration always. The reason for that is that a portion of the air has passed from the sound to the crippled lung. If you watch this drainage-tube you will see that with every expiration, not inspiration, there is a little flow of pus through that valvular opening. As I said to you, if the opening in the chest is not very large, there will be a certain following by the lung of the movements of the chest; but if it admits air freely, and if with inspiration there is no diminution of pressure in the pleural cavity on that side, there will be no expansion, but on the contrary retraction of the lung will take place, owing to a portion of air being drawn from it into the other lung.

Dr. Quimby: I think you said empyema; would you carry that to serous pleurisy? Would that flow out? It seems to me in empyema it would be necessary to consider the thickness of the pleura and the induration of the lung, as it does not expand. As you say, it is expanded by expiration. It seems to me that it might be explained by the fact that the inspiratory effort of both sides fills the non-crippled lung and pushes the solidified lung.

THE CLIMATE AND MINERAL SPRINGS OF NORTH CAROLINA.

By A. N. BELL, M.D.,
BROOKLYN, N. Y.

North Carolina is situated between latitude 33° 53′ and 36° 33′ north and longitude 75° 25′ and 84° 30′ west, comprising an area of 50,704 square miles. The State may be physically divided into three sections: First, the coast and swamp-land section, extending from fifty to eighty miles inland, which is for the most part insalubrious. Second, the middle section, extending from the termination of the swamp-land section, beginning at an altitude of about four hundred feet above sea-level and extending to the foot of the mountains, where the third section begins, at an altitude of a thousand to fifteen hundred feet, increasing in altitude and embracing the whole western part of the State—the mountainous region.

The middle section comprises a broad, undulating region, for the most part covered with pitch pine. This middle pine-forest region gradually rises into Western North Carolina, no part of which is less than fifteen hundred feet above the level of the sea. Here the Alleghenies reach their greatest altitude and show the loftiest peaks east of the Mississippi River. The range nearest the coast is the Blue Ridge, while the succeeding groups are known as the Black, Smoky, Iron, Roan, and Unaka Mountains. The lowest points or gaps in the Black Mountains are nearly as elevated as Mount Washington, while Mount Mitchell, according to the measurement of Professor Guyot, is four hundred feet higher, or six thousand seven hundred and seven feet above the level of the sea. The table-

land or mountain plateau between the ridges consists of a series of well-watered, forest-covered, or fruitful valleys and hills, from two thousand to three thousand feet above the level of the sea, and is one of the most picturesque and salubrious sections in the United States.

The annual mean temperature of the middle or pine-forest section is about the same as that of the spring and autumn months, 58°; summer, 78°; winter, 40°. The average annual rainfall in this region is about forty-four inches.

The annual mean relative humidity is about 65°; spring, 59°; summer, 66°; autumn, 68°; winter, 69°.

The pine-forest region is of exceptional healthfulness throughout the year.

In the third, or mountainous section of the State, embracing an area of about five thousand square miles, the air is from ten to fifteen degrees colder than in the middle section, but less humid and more bracing.

The climate of Asheville, at an elevation of 2250 feet above sea-level (latitude 35° 36′ north), in the lack of meteorological records for the greater altitudes, is offered as a medium measurement of the climate of the whole section.

The record of the mean annual temperature at Asheville for a series of years is 54.20°. Spring, 53.1°; summer, 71.70°; autumn, 54.8°; winter, 38.2°. This place in particular is famous for the coolness of the summers, the temperature rarely rising above 84° in the hottest days.

The average rainfall in spring is 14.05 inches; summer, 16.7; autumn, 6.5; winter, 8.4; annual, 34.21.

The winter climate particularly is remarkable for its dryness and equability. It possesses all the advantages of the most highly favored winter resorts of Southern Europe, besides the additional advantage of freedom from the sudden changes of temperature common at those resorts.

In the higher altitudes of this region, however, the variations of temperature are more considerable, frequently amounting to a difference of twenty degrees between the days and nights; requiring special care on the part of invalids with regard

to clothing adapted to the change on the going down of the sun, and the use of woollen blankets for the night.

Of other localities in this section, in default of meteorological records, I submit the following abstract of a description by Dr. Henry O. Marcy, of Boston, shortly after a visit five years ago:

"To any who seek entrance to the mountain region from the east, Asheville will be the central point of interest, and, if actuated by the restlessness of most of our countrymen, the first stopping-place. There can be no doubt but many localities upon the easterly and southerly slopes of the Blue Ridge present great attractions for invalids. A number of my medical correspondents write that some of these localities are especially desirable because of the dryness of the atmosphere and freedom from fog, which, at certain seasons of the year, prevail to a considerable extent through the mountains.

"The same general features of the landscape and climate here prevail. Along some of the southerly slopes the 'no frost line' is clearly perceptible, and sanitaria, well selected at such localities, would offer certain marked advantages. It is greatly to be regretted that careful observations have not been made at some of these places as to the equability of heat, amount of sunshine, rainfall, etc., as well as to the absence of severe cold—a fact so abundantly substantiated that it cannot be doubted, although a little distance away frost and ice are of common occurrence.

"On the Western North Carolina Railroad, at Morgantown, is located the State Asylum for the Insane, selected because of the healthfulness and beauty of the surroundings.

"The Piedmont Springs, fifteen miles north of Morgantown, have been a favorite resort for a generation, and a long, rambling hotel, venerable in service, offers attractions of quiet and rest. The springs are sulphur, not unlike the White Sulphur of Virginia, and a short distance away is a fine chalybeate spring entirely free of sulphur. The surroundings are wildly mountainous, picturesque, of a rugged Swiss type.

"A few miles south of Marion, at Glen Alpine, is a large

hotel, long a favorite resort of the residents of the Southeast. Here are said to be good springs of iron and sulphur. Lithia springs are reported at several places on the southeasterly slopes of the Blue Ridge, but little, however, is known of the medicinal value of the waters.

" . . . Near the top of the Roan a large and comfortable hotel has been erected by General John P. Wilder as a sanitarium, open during four months of the year. It is the highest inhabitable spot east of the Rocky Mountains. The difficulties encountered in the ascent make the journey a severe one for the invalid, although the railroad from Johnson City to Cranberry passes at the base of the mountain. The station called Roan is the point of leaving the rail. It has long been claimed that the Roan offered an asylum to the victim of hay-fever unequalled, but the irony of fate has in it another illustration. Now that the recluse here can be surrounded by the comforts of modern life, the old enemy continues in attendance, for hay-fever has been reported in the entire locality the last two years, including also the region about the Grandfather.

"A new avenue has been opened through the mountains from the south to Asheville, *via* Hendersonville from Spartansburg. Ten miles south of Asheville, amid pleasant surroundings, is the Arden Park Hotel, situated half way to Hendersonville; also a town with good hotels, and the entire section one of beauty and interest. A little south from here is Cæsar's Head, an abrupt 'fault' in the mountain on the South Carolina border. Much is claimed for this locality on account of its dryness, but I know of no reports of actual observations. The landscape views are extremely varied and interesting. The elevation is about four thousand feet. The hotel is well kept and is a popular resort in summer. The air is pure and bracing, and many attractions are found in the immediate vicinity to interest the invalid.

"West is Cashier's Valley, a high tableland about three thousand four hundred feet above the sea. It is of repute as a resort for consumptives. Still further west is the Highlands,

a hamlet widely advertised as a health resort. It is reached with great difficulty; indeed, to the confirmed invalid inaccessible—long distance from the rail on either side, over roads of the worst sort. Here the average rainfall has been found to be seventy inches anually, and, judging from the configuration of the abrupt mountain ranges bordering the lowlands lying south, it is presumable the rainfall of the entire region is excessive.

"Down the French Broad River one easily reaches by rail the Hot Springs, which are becoming justly celebrated. The hotel accommodations are modern and excellent, while the baths are numerous and ample. The effect of the water appears not unlike the famous Hot Springs of Arkansas.

"Westward from Asheville about thirty miles is the enterprising little town of Waynesville. In the Richland Valley, one mile away, is situated the Hayward White Sulphur Springs. The proprietor, Major W. W. Springfield, is justly popular, and his new hotel has been well filled with guests. The elevation is over twenty-seven hundred feet. The valley is very lovely, and the view of the broad meadows and lofty mountain ranges as seen from the hotel is beautiful beyond description. The waters of the creek rush along with great rapidity over the whitest pebbles, and their gentle murmuring is sweet music to the troubled heart and weary brain. Much curative effect is claimed for the sulphur water, which wells up pure and cool into a marble basin at the edge of the valley. Westward from Waynesville the railroad climbs the Balsam range to the height, at the divide, of nearly thirty-five hundred feet. The dry, pure, bracing air has attracted hither invalids, who reported to me great benefit from a few weeks' residence, although the hotel is limited and designed only as a station for dining passengers. Beyond lie the beautiful broad valleys of the Tuckaseegee and Little Tennessee Rivers, rapid streams of considerable size, only recently reached by rail. Still further westward tower the splendid ranges of the Cowee, Nantehaleh, and Valley River Mountains, irregularly dividing the wide space of the base of the triangle made by the Blue

Ridge and Smoky ranges. These are almost without exception clothed to the very top with the primeval forest which yet covers nine-tenths of the entire territory. The country beyond the iron ways is of yet greater interest to the invalid able to 'rough it' somewhat. The roads are, of course, poor; the hotels intended as hostelries only; but the quaint, old-time manners and customs of a rude but always hospitable, honest people are a never-failing source of interest, and often of profit, to the student of men as well as Nature.

"The valley of the Nantehaleh is of interest as a broad plateau between the ranges, watered by the loveliest of rivers. Its banks are thickly hedged with kalmia and rhododendrons, which in June present a mass of bloom never seen outside these mountains. The delicate branches of the graceful birches gently sway in the breeze, the music of the laughing waters fills the air; all else is the unbroken silence of the primitive forest. Mr. L. R. Finch, who resides on a cattle ranch in the Nantehaleh Valley, has sent me a daily record of the weather during the past summer. The rainfall has been large and the variations in temperature considerable. On June 13th there was a frost and a temperature record of 30° F. I found the two weeks which I spent here during August of the present year very agreeable, although a fire, morning and evening, was a comfort. Frost was reported about the 20th of the month.

"The Valley River Valley surpasses all the others in beauty and picturesqueness; broad and fertile, and landscape rarely equalled, set in a mountain frame of living green, of which the eye never tires. The small hotel is ever full, and when proper accommodations can be reached by rail it will become a popular resort."[1]

[1] "The Climate of the Southern Appalachians." By Henry O. Marcy, A.M., M.D. LL.D.; Transactions of the Ninth International Medical Congress, vol. v.

Mineral Springs Analyzed.

Acidulated Waters.

Glen Alpine Springs, W. C. Kerr, analyst:

	Grains per gallon.
Magnesia	0.25
Lime	1.72
Iron oxide, Alumina	0.92
Silica	1.60
Chlorine	0.37
Sulphuric acid	0.74
Carbonic acid	32.22
Organic matter	1.79

Greensborough Spring, W. C. Kerr, analyst:

	Grains per gallon.
Soda	0.27
Magnesia	0.42
Lime	1.62
Iron oxide	0.60
Alumina	0.18
Silica	2.10
Chlorine	0.42
Sulphuric acid	0.12
Carbonic acid	large amount.
Organic matter	1.02

Calcareous or Earthy Waters.

Charlotte Mineral Springs, W. C. Kerr, analyst:

	Grains per gallon.
Calcium sulphate	36.00
Magnesium sulphate	4.53
Sodium chloride	3.30
Iron	trace
Alumina	"
Silica	18.97

Cleveland Mineral Springs, Catawba County, White Sulphur Spring, same analyst:

	Grains per gallon.
Calcium carbonate	4.50
Calcium sulphate	18.70
Magnesium chloride	7.65
Calcium chloride	4.84

Ellerbe Spring, C. W. Dabney, Jr., analyst:

	Grains per gallon.
Calcium carbonate	3 64
Calcium sulphate	4 56
Sodium chloride	0.80

Cowhead Spring, W. C. Kerr, analyst:

	Grains per gallon.
Magnesia	0 06
Lime	1.17
Iron oxide } Alumina }	0.86
Silica	3.76
Chlorine	0.18
Sulphuric acid	1.23
Organic matter	5.79

Red or Iodine Spring:

	Grains per gallon.
Calcium carbonate	3.12
Calcium sulphate	17.42

Park's Alkaline Mineral Spring, Caswell County, A. R. Ledoux, analyst:

	Grains per gallon.
Calcium carbonate	4.80
Sodium sulphate	1.48
Magnesium sulphate	1.50
Sodium chloride	trace
Iron oxide	3.50
Alumina	3.50
Silica	trace
Sulphur	0.15

Panacea Spring, near Littleton, W. C. Kerr, analyst:

	Grains per gallon.
Soda	2.23
Magnesia	0.20
Potassium	0.70
Lime	1.20
Manganese	0.01
Iron oxide	2.18
Alumina	0.30
Silica	1.18
Phosphoric acid	0.53
Hydrochloric acid	0.81
Sulphuric acid	0.43

Chalybeate Waters.

Iron Spring, Madison County, ——, analyst:

	Parts in 1,000,000.
Magnesium	7.4
Calcium	140.8
Iron	31.9
Manganese	trace.
Silica	72.1
Carbonic acid	304.6
Organic matter	38.2

Dennison's Mineral Well, Warren County, ——, analyst:

	Grains per gallon.
Calcium carbonate	12.58
Sodium chloride	4.94
Iron	4.40
Alumina, Silica	3.48

Kittrel Springs, Granville County, C. W. Dabney, Jr., analyst:

	Grains per gallon.
Iron carbonate	9.20

Spring at Icard Station:

	Grains per gallon.
Iron carbonate	2.50

Alum Spring, Onslow County, W. C. Kerr, analyst:

	Grains per gallon.
Magnesia	0.49
Lime	4.80
Iron oxide, Alumina	3.8
Silica	1.65
Chlorine	0.92
Sulphuric acid	0.25
Organic matter	5.16

Saline Waters.

Chatham Mineral Springs, C. W. Dabney, Jr., analyst:

	Grains per gallon.
Sodium chloride	28.80
Magnesium chloride	36.56
Calcium chloride	39.13
Sulphates	trace.
Nitrates	"
Iron oxide	"
Alumina	"
Silica	"

Mineral Well, Thomasville, W. C. Kerr, analyst:

	Grains per gallon.
Soda	1.09
Magnesium	0.75
Lime	1.74
Iron oxide, Alumina	0.14
Silica	1.01
Chlorine	2.62
Phosphoric acid	0.40
Carbonic acid	0.82
Organic matter	3.95

Hot and Warm Springs.

Bathing Springs, 92° to 117° F. Madison County, Dr. E. Adelmarth, analyst:

		Grains per gallon.
1.	Sodium sulphate	0.03
	Calcium sulphate	40.88
	Magnesium sulphate	1.34
	Potassium sulphate	0.36
	Soluble silicates	8.97
	Sodium chloride	0.91
	Magnesium chloride	0.22
	Calcium chloride	10.10
	Potassium chloride	0.31
2.	Sodium carbonate	3.68
	Sodium sulphate	4.24
	Magnesium sulphate	7.64
	Iron crenate	2.34
	Sodium chloride	2.46
	Calcium chloride	11.48
	Silica	3.82
3.	Calcium sulphate	17.56
	Magnesium sulphate	7.50
	Magnesium chloride Calcium chloride	5.00

Drinking (Warm) Springs:

	Grains per gallon.
Sodium sulphate	8.90
Calcium sulphate	40.54
Magnesium sulphate	8.13
Potassium sulphate	0.47
Soluble silicates	9.54
Sodium chloride	1.10
Magnesium chloride	0.37
Calcium chloride	8.94
Potassium chloride	0.50

Warm and Hot Springs, Buncombe County, in the northwest part of the State, on the western branch of the French Broad River—a beautiful and romantic region embosomed in lofty mountains—there are several springs, varying in temperature from 94° to 104°. Analysis of the water by Professor E. D. Smith (*Silliman's Journal*, vol. viii.) gives the following results:

	Grains per gallon.
Muriate of lime and magnesia	4
Sulphate of magnesia	6
Sulphate of lime	14.05
Insoluble residue	2.05
Loss	1
	27.10

Equal to 4.66 grains solid in a pint.

The waters have long been commended by many physicians for bathing, as well for internal use, in chronic rheumatism and gout, and hepatic engorgements.

Reputed Qualities—No Reliable Analysis.

Chalybeate Waters.

Kittrel Springs, Vance County.

Lawrence's Chalybeate Springs, Murfreesborough County.

Lemon Springs, two miles from Munn's Station, Moore County.

Misheman's Springs, near Bilesville, Stanley County.

Piedmont Springs, near Danbury, Stokes County.

Seven Springs, Wayne County.

Strader's Mineral Springs, three miles from Pelham, Caswell County.

Wise's, Murfreesborough, Hertford County.

Yadkin Mineral Springs, chalybeate sulphuretted, Palmerville, Stanley County.

All-healing Springs, chalybeate sulphuretted, Gaston County.

Alum Springs, chalybeate sulphur, near Catharine Lake, Onslow County.

Cowhead Springs, four miles north of Washington, Beaufort County.

Henderson Mineral Springs, one mile from Henderson, Vance County.

Jackson Springs, Moore County.

In the very heart of the pine forest and sandy soil region,

at Southern Pines, Moore County, there are also several chalybeate springs, and one at least sulphurous, of evident value, but no reliable analysis of these waters has yet been made.

Saline Waters.

Panacea Springs, Halifax County.

Sparkling Catawba Springs, saline and carbonated, six miles from Hickory, Catawba County.

Chatham Mineral Spring, near Pittsborough, Chatham County.

Glen Alpine, saline carbonated, ten miles south of Morganton, Burke County.

Sulphuretted Waters.

Manganum's Springs, one and one-half miles north of Chapel Hill, Orange County.

Piedmont Springs, sulphuretted and chalybeate, Burke County.

Sue Spring, near Warrenton, Warren County.

Sulphur Springs, Montgomery County.

Sulphur Springs, near Petra Mills, Caldwell County.

White Sulphur Springs, at Catawba, Catawba County.

Blackwell's White Sulphur Springs, four miles from Alexandria, Buncombe county.

Cleveland Mineral Springs, sulphuretted chalybeate, near Shelby, Cleveland County.

Jones' White Sulphur and Chalybeate Springs, nine miles from Shocco.

Eupeptic Springs, fifteen miles north of Statesville, Iredell County.

Henson's White Sulphur Springs, near Island Ford, Rutherford County.

Uncharacterized Waters.

Ashley's Bromine and Arsenic, Ashe County.

Barium Springs, Iredell County.

Black Mountain Iron and Alum Springs, Black Mountain, Buncombe County.

Bell Spring, Palmerville, Stanley County.

Burke's Chalybeate Springs, near Taylorsville, Alexander County.

Chalybeate Mineral Spring, near Varina, Wake County.

Chalybeate Springs.

Near Marion, McDowell County.

Five miles south of Wadesborough, Anson County.

West of Sanford, Moore County.

One and a half miles west of Ellerbe Springs, Richmond County.

Near Laurinburg, Richmond County.

Near Shelby, Cleveland County.

Charlotte Mineral Spring, Charlotte, Mecklenburg County.

Dennison's Mineral Well, New Berne, Craven County.

De Hart Springs, near Nantehaleh, Swain County.

Ellendale Chalybeate Springs, Ellendale, west of Taylorsville, Alexander County.

Ellerbe Springs, Richmond County.

Ewing Springs, Sulphur Springs, Montgomery County.

Haywood White Sulphur Springs, Waynesville, Haywood County.

Healing Springs, Healing Springs, Davidson County.

Jones' White Sulphur and Chalybeate Springs, ten miles south of Ridgeway and eleven miles from Warrenton, Warren County.

Leinster or Poison Springs, five miles south of Statesville, Iredell County.

Lewis Spring, near Green Hill, Rutherford County.

Lincoln Lithia Springs, Lincolnton, Lincoln County.

Loudermilk Sulphur Spring, five miles west of Taylorsville, Alexander County.

McBride's Springs, near Shelby, Cleveland County.

Millstead's All Healing Mineral Spring, near Ellendale Alexander County.

Min-ne-kah-ta Springs, Gaston County.

Mount Vernon Mineral Springs, Mount Vernon Springs, Chatham County.

Rocky River Springs, near Silver, Stanley County.

Shaw's Healing Springs, one-half mile north of Littleton, Halifax County.

Shocco Springs, five miles from Warrenton, Warren County.

Stonewall Springs, six miles from Graham, Alamance County.

Sulphur and Chalybeate Springs, on French Broad River, Madison County.

Sulphur Springs, five and one-half miles southwest of Asheville, Buncombe County.

Also, ten miles northwest of Asheville, Buncombe County.

Warren White Sulphur Springs, ten miles from Ridgeway, Warren County.

Mineral Springs:

At Ansonville, Anson County.

Ten miles southwest of Tradesborough, Anson County.

At Haw River, Alamance County.

At Icard Station, Burke County.

Seven miles northeast of Asheville, Buncombe County.

Near Rock Spring, Orange County.

At Greensborough, Guilford County.

The State is indeed remarkably rich in mineral springs, but unfortunately, as may be observed by the foregoing enumeration, there are comparatively few whose properties are thoroughly known and rendered available by analysis and needful local improvements.

DISCUSSION.

Dr. Darlington: This paper has given me much pleasure, particularly that part of it referring to the climate of North Carolina.

Personally, I do not believe that the matter of climate has a great deal to do with disease, certainly not with phthisis.

If we go to Oregon, where the rainfall is very great, we find that it is far more healthful than drier sections of the country, as Colorado and New Mexico, where there is little or no rainfall. You will find as many rosy cheeks in London where there is little sunshine as on the Western plains where the sun shines every day.

There is one thing about sending patients from home. Commonly these patients have little money, and leave pleasant family relations and homes in the East; and when they go off to a distance, to most places in the West, it takes a large portion of the sum of money laid by to get there, and the family are usually pinched by their going away; so the patients are constantly worried. They leave pleasant homes to go to a hotel with poor accommodations, to sleep under blankets which are cheap and heavy, in bed-rooms, possibly, full of vermin; where the meat has the odor of freshness so offensive to invalids—and in truth, where they are asked to live on the climate.

I remember hearing a fellow one day, up this State in Pike County, complaining bitterly of the hotel accommodations. I said, "Look at the view; what a pretty place!" "Yes," he said, "but you can't sit down on it, nor can you eat it." And that is the way with most of the places you go to.

I was glad to hear the paper of Dr. Bell, because it points out a place nearer home for patients to go, and where they can get better accommodations than at a distance. I think there are as good places near by as at a distance—if it is desirable to send patients anywhere at all.

The cases must be carefully selected. I sent a man to Asheville, and he lost two pounds in a week. He had been keeping even. It was the worst thing that could have happened to him. He was short of money and worried about it; he got in a worse condition than he had been before, and as though he was not going to get over it.

St. Augustine is considered not good for consumptives, it is thought too damp. I sent a patient there who gained twenty pounds in ten weeks. This shows that it is not always the amount of rainfall or the sunshine that makes a climate beneficial or not. I know while I was West I would have given anything if it had drizzled a week, so that I could have stood in it and got soaked. Sunshine there becomes very tiresome, especially in those places where the sun glows like fire.

I like to hear of places nearer home, where there is vegetation, some place not infected by the sick that have been there.

Formerly few cases of consumption originated in California; now there are a great many. The same has happened there as in the Riviera.

I believe that in the pine woods between the mountains and the swamp-land, where there is no malaria, with a climate like North Carolina, where there are railroads and good hotel accommodations, where it will not cost a great deal to get there, where patients can get

home when they wish, and correspond quickly with friends in the East, and where they will not feel far away from home, is the place where we should send patients, if anywhere, although I doubt if climate has much effect.

Dr. von Ruck: I believe that the speaker has startled us all in saying that climate has no value in the treatment of consumption. It is a new departure, and, if true, I think that the Climatological Association had better disband. I do not know whether this gentleman has ever lived in North Carolina, or that he has ever been in Asheville. The picture he draws with regard to accommodations, etc., probably corresponds to Arizona, of which he spoke to us so entertainingly yesterday; but I contend that we have in North Carolina, and especially in Asheville, where most invalids go, as good accommodations as they are willing to pay for; and if they have no money they had better stay at home.

He spoke of a patient whom he sent to Asheville, and who lost two pounds there in a week. Some people who go to Asheville or to other resorts die there; and some of them die before they get there. That depends on the condition of the patient before he is sent; and it also depends upon what the patient does while he is there. If he follows a foolish course and does everything that he should not and nothing that he should, the climate cannot protect him, and he will probably do badly.

I believe that the utility of climate in the treatment of phthisis is so well established that I need not detain the Society with reference to it. I wish only to add that I am much interested in the paper of Dr. Bell; and while his data is somewhat old in the description of places, it gives a general idea of that section of North Carolina which is of particular interest as a health resort. Asheville is usually suggested on account of its accommodations being more favorable than in the little out-of-town places. It has a medium elevation, medium humidity, and medium temperature; it is free from all extremes; and from the results obtained in Asheville, I am quite sure I am justified in expecting that Asheville will always have favorable consideration by the profession in the selection of climatic resorts for their patients.

Dr. Darlington: I do not mean to say that climate has nothing whatever to do with disease. I mean to say that doctors frequently send patients long distances, irrespective of whether they are able to go or not. I was glad to hear Dr. Bell's paper, because it points out a place nearer home. Colorado is an exceptional place, and there are conveniences of living for persons who can afford it. It is very nice if they can camp out of doors. I think it is a wonderful advantage in any disease, where the patient can have exercise and change; but climate in itself, alone, does not do the work; but pure air, with a moderate temperature, is a great advantage. That is one point.

The other point that I wish to make, is that I do not believe that a moist climate has much influence; if it has any influence at all, in advanced cases it seems to be of benefit. I would like to give you an instance. In speaking of the West I did not mean Arizona. I have been in almost every State and Territory in the United States, and I meant everything beyond the Mississippi. In regard to Arizona, where I was located, there is a condition of almost absolute dryness, as near as it is possible to get it. It did not rain for thirteen months, and the dust was more than knee-deep. You cannot get a condition of greater dryness than that; and yet we generally associated with it acute rheumatism (inflammatory) although that is generally associated with moisture. I never saw so many cases as when the weather got dry in the spring. It generally ran from September to about May; it was epidemic. I think this is of interest and should be studied. The climatological status is of great importance, as I do not think the general lines on which these have been studied are understood. I think that the matter of moisture alone has been generally misunderstood. I do not want to be understood as saying that climate is an absolute failure for some things. I think, generally speaking, a rainy climate is as good as a dry one, that is, according to personal experience, but based on climate alone, is of no value; and North Carolina is as good as any place in the West, and it is probably better, as it is nearer home. I have three cases of phthisis in Arizona—originated there. Twelve or fifteen cases suffered so much from dust and elevation that I tried to get them away. The few who stayed suffered greatly.

Dr. Walker: I would like to say in connection with Dr. Bell's paper and Dr. von Ruck's remarks: From some little experience in sending patients South, I believe that there are months when patients can do better than go to Asheville. My advice is generally, when sending a patient South, to migrate from place to place, according to the influence of the special locality upon him, the accommodations he finds, and the season. In January, I believe that Florida is better, down along the Indian River, for instance; during February, he may stay there or go to Marietta, Ga., or Thomasville. During March and April he had better stay away from Asheville, remaining at Thomasville at least during March. When I sent patients to Asheville formerly, I told them they would get two things; elevation and pure air; and those who rode, horseback riding. They got the horses, but the roads during those two months are inclined to be "mud to the horses' knees;" and as among the objects of sending patients to a salubrious climate is out-door exercise, I believe that Asheville at this time does not supply the need. I do not believe there is any one locality which we can can pick out for the entire winter, in my small experience. It has been my habit in sending patients South to have

them move from point to point; and move north as the warm weather comes on, advising them not to return to Philadelphia until May.

Dr. von Ruck: Dr. Walker remarked that Asheville is not a desirable place in the winter. He must refer to the exceptional conditions having existed in Asheville two winters ago, and which have not obtained either before or since. We did have, two winters ago, during February and a part of March, a continuance of rainy weather. The roads were muddy and almost impassable, but the whole country and especially all Southern and California resorts were equally afflicted. Still, I cannot say that I found less improvement in my patients by having them largely restricted to the grounds and piazzas for exercise; on the contrary, they did very well. The fact that my patients could not ride horseback during that time, I think was to their advantage; and I am well satisfied that they need not ride horseback or take any other kind of violent exercise to get well of consumption. I find more patients injured by such exercise than are ever benefited.

The majority of patients who come to Asheville or other resorts are not those physically robust and strong, but those who have lost in vigor and strength; they frequently have fever and are emaciated; to put such patients on horseback exercise, I don't care on what roads, means simply to invite relapse.

The condition of the streets and the roads in and about Asheville has much improved in the last two years. There has been expended a half million of dollars in street improvements by the city, and a quarter of a million for country roads has recently been authorized; but if, on that account, the patients coming to Asheville will take still more exercise, I am sorry for it, as it would lead in many instances to more frequent relapses on account of physical over-exertion. The paper read by Dr. Mays is important in this connection. The great majority of relapses which I see are due to over-exertion which we can and must prevent.

I believe that Asheville, in the winter, as well as in the summer, presents all the conditions essential for climatic treatment, and patients will improve in Asheville in any month in the year if their cases are properly managed.

We all recognize the importance of elevation in climatic treatment; therefore Florida and other places of the lower South having none, are not as desirable.

In those cases where prolongation of life is all that can be hoped for, and a cure or arrest of the disease is out of the question, regions like Florida are better in the winter for such exhausted and emaciated subjects—with them it is merely a question of pleasant, warm weather. If a patient is sent to a place and improves he should stay there until he is well; and he should not go back to Philadel-

phia in May, or with advent of better weather at home, as Dr. Walker suggests, but when the disease is well arrested.

DR. WALKER: I do not wish to be understood as advocating horseback riding as a routine treatment for phthisis. Phthisical patients are not the only cases to which I referred. I include the over-worked, those suffering from nervous exhaustion, and convalescents. "The best thing for the inside of a man is the outside of a horse," is true of many phthisical patients as well as others. I do not believe in sending patients to Asheville, the sanitarium of the gods, for *advanced* phthisis. If *I* had that I would not be satisfied this side of Colorado, with any hope of benefit. I believe that Asheville presents the best climatic resort on the Atlantic seaboard, on account of its altitude and its improved and improving accommodations.

DR. RUEDI: In the way of dryness you can get too much or too little, just as in anything else. If the air is too dry for any length of time, I have frequently seen lungs which were formerly dry, become irritated in the smaller bronchial tubes, and you have fresh crepitation in consequence. I have written on this subject two years ago, and my views have been published; and I stated then that the simple use of a steam-kettle in the bed-room of these patients was sufficient to give relief, particularly at night during sleep. It is the same thing with temperature, we can get too much, and too little cold or heat. Those climates are best where there is a medium temperature and dryness, and the changes not too sudden; and it is the duty of the Climatological Association to find out those degrees of dryness, sunshine and temperature which are most beneficial to the abnormal or diseased body, and in this respect alone, I think, the Climatological Society has a right to call itself a society in connection with the medical profession, otherwise it would become merely a meteorological society.

Rheumatism is a very strange disease. I am obliged to say that my ideas about rheumatism vary greatly from the ordinary. We have a rheumatism which originates in dry, and one which originates in moist climates. When the air is dry for a long period of time, rheumatism, particularly that of the muscular variety, is very frequent; and the best treatment is to send the patient lower down to a moist climate; and if it originates in a damp climate in Georgia or Florida, a removal to a dry climate is the best for it. It is the excess of moisture or dryness which originates it.

I wish to speak of the infectiousness of tuberculosis in answer to the letter. Large statistics have been collected, and have already been ventilated. I only need to remind you of the statistics which H. Weber has published. He took out of his own books ten thousand cases of phthisis and analyzed them, and found ten cases where there was a supposition of infection from person to person. So he says that the percentage is so very small that we are almost entitled to

neglect it. This would be $\frac{1}{100}$th. The infection in his cases came nearly always from the husband to the wife, or the reverse; and only in two instances did he think that persons living in the same room as nurses, etc., became ill while attending to the patients. C. T. Williams, London, followed up all the resident physicians and all the nurses employed in the Brompton Hospital for twenty-five years, attending successively on tuberculosis and phthisis, and he found two nurses and one doctor succumbed to this disease; and he said that the two nurses were more or less ill when they entered the hospital; and the doctor died in my treatment at Davos, and his family history was very bad, his father, grandfather, and two brothers died of consumption previously. In my own practice I have seen three cases where the infection was clear. One, that of a gentleman who was ill and ordered by H. Weber to go to Madeira; and he went there with his wife who was well. They lived together in a small room, and the husband improved from hour to to hour, and got so far better that he was able to go back to London the next spring; but about the same time his wife became ill with consumption; and as soon as the wife was brought back to London and examined by Weber, he sent her to Davos, and she came into my hands. This, I think, is a pretty fair example of infection with tuberculosis. The wife had a good family history. I had two more cases which showed infection. One case was a washerwoman in Davos, employed to wash handkerchiefs and bed-linen from the infirmary. She did this for five or six years, and was wet nearly all the day long. She got consumption and died. But where the occupation is such that it necessitates constant dampness and work in water, it is questionable whether this is able to produce consumption, or whether it was direct infection. The third case was that of a servant-girl attending on a gentleman, who unfortunately made use of her in many ways; they lived together nearly as man and wife. He died in April, and this girl showed the first signs of consumption in the beginning of September. She got over it.

Another point in this letter is the alteration in the death-rate by consumption among negroes in that village. I made the same observation among Swiss peasants. My father, who was twenty years a physician in Davos, in writing a paper said he had never seen a case of scrofulosis in his long practice in that valley. I came into the same valley thirty years later—in 1874—and the medicine I mostly used in those two years was iron, cod-liver oil, and iodine with children for scrofulosis. What was the reason for this? The altered condition among the country people. It was nothing else than the development of Davos as a health resort. Formerly, when my father practised there, the people lived on their milk, butter, cheese, and meat; they were in the open air all the time, living a good wholesome life, with plenty of food at that time. A pound of trout cost fifteen

cents, butter five cents a pound, and eggs were not counted, but given away; and living was so cheap that everybody had plenty.

With the development of the health resort, where five to eight hundred or a thousand people rushed into the valley, who had all to to be supplied with food, circumstances altered considerably. The farmers wanted money, and gave their milk into the creameries and got money for it; instead of giving the children milk to the utmost, or using the milk as the common beverage, they got much coffee and a little milk in it; instead of eating cheese they got potatoes; the farmers tried to make money, and in consequence they lived below their standard. The same thing would happen to the children of the farmers; they didn't like to go into the fields any more, especially after they had learned a little English or French, but went into the hotels as servants or chambermaids; they went into large buildings, lived badly, slept in bed-rooms ten or fifteen girls together, and so scrofulosis came in, and since then it is a frequent disease in Davos. The same thing probably took place with these negroes. Formerly the negroes had their masters, had good food and plenty of it; they had to do their accustomed work in the open air. Now that they are masters of themselves they take to drinking, and sometimes they have something to eat and other times not; and consumption found the doors and windows open for its entrance.

Dr. Peale: In regard to Dr. Bell's paper on the springs of North Carolina, it seems to me that there are two points which ought to be emphasized. We have lists of springs from one end of the country to the other, and analyses of a certain sort. What we need now are analyses of springs taken from all parts of the country by chemists working on the same plan, so that the analyses can be compared. The analyses we now have are not comparable at all. Each chemist states his analysis according to his own plan. We also lack a therapeutic study of the mineral waters. I do not know whether we will ever get it, but if the physicians located at the different resorts were to make a study of the effects of the waters we would be in a much better position than now. As to the springs of North Carolina, never having visited them, I do not feel competent to say much about them. Dr. Bell seems to have exhausted the subject.

As to the climate west of the Mississippi River. My experience of the West dates back to 1871. I have been in every State and Territory with the exception of Nevada, and a great variety of climate is found in the entire country west of the Mississippi. I am more familiar with Colorado and Montana, the latter especially, as I have been in that State a great deal since 1883. We have considerable variety there, the temperature ranging from 50° to 60° below in the winter to 105° in the shade in the summer—that is a considerable range, you see. There is a range so far as moisture is concerned. I

have been kept in camp two weeks at a time early in the season because the roads were impassable, and I have also camped there from the last of July to October without a day's rain. Yet notwithstanding this range of temperature and moisture, my personal acquaintance in Montana includes a great many people who were given up by their physicians in the East and middle West with consumption, and who are now thoroughly well. As to accommodations, I fear Dr. Darlington's experience has been unfortunate. Every one knows about Colorado; and the accommodations of Montana are fair in certain parts.

We have a great range in elevation—we have it from 2000 and 3000 feet to 11,000 and 12,000 feet, the valleys in the mountain region ranging from 4000 to 8000 feet, and in one or two cases 9000 feet. The State as yet is not very well settled, but there are many places, as the Deer Lodge Valley, the Gallatin Valley, and others, where the accommodations are as good as any in Colorado, or even in the East.

The climate is not the only factor, personal equation enters very largely into the case. I do not think Montana is a good place for nervous people; they can stay awhile, but they have occasionally to go to a lower elevation. On the whole, the general elevation of Colorado is greater than that of Montana.

Dr. Walker: Is there any portion of Montana particularly that has shade?

Dr. Peale: We have one of the best timbered regions of the West in the northwestern part of Montana. In the eastern part of the State you find none. You must get into the mountains. The eastern part is like Dakota, it is the home of the blizzard. We do not have these in the western and northwestern parts. My experience has been principally in the Gallatin Valley; there you have streams coming from the mountains, and I think one of the most delightful climates in the world. One of my men worked there with me for ten years, and thought he would return to California, from whence he came. He went home, but soon returned, saying that he liked Montana much better on account of the variety of climate. California was too monotonous for him.

Dr. Gihon: I heartily emphasize what Dr. Ruedi has said, and which I consider one of the most important statements ever made in this body respecting the mal-alimentation of certain country places in Switzerland through the divergence of food products and former means of subsistence from the natives as consumers, thus causing marked increase in the local disease-rate. I also suggest it as a probable cause of the increase of disease in many of our own rural districts in New Jersey, Connecticut, and New York. I know it to be a fact in New Jersey, not far from this city, that there are farmers who never eat other than salted meat, living chiefly on salted pork, and who do not eat their vegetables, fruits, or poultry, sending them to

the markets of neighboring cities. Indeed, there are many hotels in small country places which get their supplies of such articles from New York, these having been bought by produce dealers, shipped to New York, and then resold by middlemen and shipped back to the places where they had been raised. Undoubtedly, in many of our rural localities, which are becoming notoriously morbific centres, the explanations may be found in the fact that proper food is not consumed by the inhabitants, but is sent away for profit.

Dr. Bowditch: Although the discussion has taken a rather broader standpoint than was involved in the paper, it seems to me of such vital importance that we should continue it to a certain extent. It seems to me that Dr. Ruedi has covered the ground. We must take the wiser medium course and not adhere to extremes. Dr. Darlington said some startling things with reference to moisture. I certainly think what he says with regard to Oregon is striking, but at the same time I think it has been sufficiently proven both by Buchanan and Simon in England, and thirty years ago by my father in New England, that residence upon a damp soil is very productive of consumption. Then Dr. Darlington spoke of rosy-cheeked children in London, which is true; but all forms of bronchial troubles are rife in that city.

In regard to Asheville, it brings up other points in my mind. I can only speak from personal experience with regard to patients. The experience of those who would not enter the Winyah Sanitarium, where I have tried to get them to go to, has been such that I have advised others to go to a lower altitude during the later winter months and early spring, as I have had patients say it is so damp and chilly during that time in Asheville. I have only had their practical experience to judge by, therefore I merely advise those persons who are unwilling to enter the Sanitarium to go to the sand hills in States further south—South Carolina or Georgia—in February, March, or early April. What Dr. Von Ruck says about the negative effect of the weather upon his patients in the Sanitarium during these less favorable months, I believe to be perfectly true, and this only emphasizes the fact that sanitarium treatment is of the greatest importance. I feel this more and more as time goes on. With my slight experience at the Sanitarium at Sharon, Mass., I feel that climate makes less difference while the patients are in a properly regulated sanitarium; and this has been the experience with Dettweiler in Falkenstein near Frankfurt, in Germany. We know what a cold and chilly German winter is, yet his results are splendid. The elevation of Falkenstein is not quite as high as that of Asheville, I believe.

Dr. Bell, in concluding the discussion, emphasized the scope of his paper to describe conditions without expressing any preference for localities. His views in this regard, however, he thought were

well known to the Association by his previous papers on pine forests and the ocean atmosphere, particularly his paper before the Association in 1889 on the "Influence of an Ocean Atmosphere on a Staid Population, with Special Reference to Pulmonary Consumption," as affecting the inhabitants of Turk's Island, almost at the level of the sea, among whom the ratio of deaths from pulmonary consumption was smaller than that of any similar population of which he had knowledge, exclusive of similar conditions. But the *chief* attribute of an ocean atmosphere was, in his judgment, its *cleanness*—an attribute which applied to other environments proportionally as they comprised it, wholly regardless of altitude.

Referring to the influence of damp soil as being promotive of pulmonary diseases, it was no more so, he thought, than of other diseases. "It is," he said, "the *dirty* soil moisture that makes people sick, and not the moisture *per se*." In verification of this he referred to observations where persons who were obliged to camp out on a dirty soil in a tropical climate were protected by sleeping on leather sheets under fluffy mosquito bars or light blankets.

The salubrity of pine forests he had described in a paper read before the Association on "Southern Pines" seven years ago; it is due to the natural drainage of the soil. All observers know that pine thickets are of very thrifty growth, and at the outset generally dense. The central or tap-root of the pine penetrates the earth perpendicularly, and sends out radicals all around. By the end of the third or fourth year they begin to thin out by the death of the weaklings, by which time the tap-roots have penetrated to the depth of about eighteen inches, and the radicals form an interlacing network of the soil. These sappy roots decay with wonderful rapidity, and leave in their places an inimitable network of soil drains.

The extraordinary mortality of negroes, and particularly of mulattoes, from consumption, which had been referred to, he attributed to their poor food, filthy habits, and stifling sleeping-rooms. "Never shall I forget," he said, "that more than fifty years ago, when I was a medical student in this city, the late Dr. John Neill took me to certain lodging-rooms in Philadelphia where there were boarders at twenty-five cents a week on food that was collected by beggars from door to door, and where I observed the filthy straw upon which the scrofulous and consumptive creatures slept. I had learned something about the habits of negroes, if neglected, at my native home, but had never before seen such dens of disease." And here a word may be said with reference to the relation of consumption to bed-rooms generally—even among the cleanliest of people—which there is reason to fear have recently been overshadowed by too exclusive attention to the great discovery of Koch. I say this with utmost deference to the genius of that great bacteriologist, but as a preventive measure it

appears to me to stand in pretty much the same relation as quarantine does to local sanitation. It has distracted attention from bed-room sanitation and local conditions, and stimulated the effort of drowning men to catch straws. Many invalids and some doctors have been led to think so much of the specific cure-all that the need of well-ventilated bed-rooms, wholesome food, and well-regulated exercise have been relegated into the background.

What Dr. Gihon has so well said with regard to the stinted diet of some country people, in order to send their better food to market, is doubtless in some measure due to the same influences—distracted attention from healthful regimen and surroundings by the false repute of "specifics" and fads. Indeed, a case now recurs to mind illustrating it. An editor, whose opportunities for knowledge had been much better than those common to the countryman who stints himself for profit, had well nigh dieted himself to death by the exclusion of fat meat, and who took such good care of his strength that he habitually took the elevated railway between his residence on Fortieth Street and Printing-house Square, New York, about two miles, twice daily, lest he should exhaust his strength. That his strength finally did become so exhausted that he was obliged to take a recess, was not surprising to any one having knowledge of sanitary regimen. He was persuaded to go to Colorado. There he fortunately fell into good hands, and a few months thereafter he wrote: "Since I have got here I have learned to eat fat bacon and corn-bread, and can walk four or five miles a day without fatigue." Had he walked between his house and office daily, in New York, been scrupulous with regard to personal cleanliness, and seen to it that his bed-room was thoroughly clear of dust and well aerated, as he was taught to do in Colorado, he would have long before cultivated a taste for fat bacon and corn-bread, and his strength would not have given way. And pray, who among us here that does not recall the description by the venerated Bowditch, before this Association, three years ago, of his father's tour through New England in an open buggy, after being greatly reduced by frequent attacks of pulmonary hemorrhage and deemed to be in extremis, living on bacon and eggs the while, by which he regained health and strength and lived to an old age? And in the same connection, I remember another hero—of a different type—the late Admiral D. G. Farragut, under whom my naval service began, and his first cruise as commander. Never shall I forget the story he told me of an incident in his early naval life, when his health had broken down—doubtless on account of the stifling atmosphere of the unventilated steerage in which he slept, though he did not specify it. He consulted the celebrated (late) Dr. Jackson, of this city, who advised him to go home and make himself as comfortable as he could—until he died, was understood. On getting home, he found the family physician, at

Norfolk, equally conservative. Realizing the desperateness of his condition, he determined to make the most of it. Providing himself with a gun and a dog, and with a bird-bag well-filled with ham-sandwiches to begin with, he took to the Dismal Swamp. There he spent most of his time for the next six months, and for more than half of the nights slept out of doors. At the end of the period he had regained his health, and returned to duty. How well he did it the whole world knows. It was all brought about by breathing a pure atmosphere. It was during subsequent service under the same commander that I first had occasion to advise the use of leather sheets when obliged to sleep on damp ground, and loose-textured blankets, or fluffy mosquito-bars over the face for protection against a malarious atmosphere.

With regard to what has been said of rheumatism as being equally the result of either too little or too much atmospheric moisture, I think it is only apparently so, not really. The pains of rheumatics, on account of changes in altitude or atmospheric moisture, are due to the changes in the density of the atmosphere in the body as well as out of it, affecting the tissues otherwise made tender. We all know that our corns ache on the approach of damp weather—under a rarified atmosphere, and *vice versa*. And most physicians can call to mind rheumatic patients who are good barometers in this respect. The late Professor Dunglison was wont to tell the story of one so sensitive to change that he used to change his sleeping-room with every change of the wind.

Dr. Peale's suggestions about the therapeutical properties of mineral waters affords me the opportunity to say that my purpose in what I have written with regard to them has been the same as with regard to climate: to describe them as completely as practicable, but to leave their therapeutical application to medical practitioners.

Respecting country sanitariums for consumptives, it is to me a gratifying sign of progress in the treatment of consumption to know that such institutions are increasing in number; and that hospital wards and city hospitals for consumptives are sinking into deserved disrepute. I have for many years felt obliged to say to all who have sought my favor to sustain a city hospital for consumptives: "No, but I will contribute to its destruction." Indeed, I know of no means more promotive of the speedy death of persons afflicted with consumption than crowding them together in the same ward, or even into the same hospital exclusively, as provided in city hospitals for that purpose.

But sanitariums are of a wholly different character. They contemplate situation in the country; a pure atmosphere; as much out-door air as possible; separate sleeping-rooms; in short, sanitary conditions in detail.

QUINSY, AND ITS TREATMENT BY EARLY INCISION.

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The subject of this paper may perhaps seem better suited to a society of specialists rather than to an organization like this, made up for the most part of general practitioners. And yet there is probably no one present who has not at some time been obliged to act promptly and without the aid of a surgeon in a severe case of phlegmon of the fauces. The writer, at all events, has been placed in such a situation more than once, and a recent experience of the kind has led him to make a somewhat extended study of the subject.

Until within recent years the affection we are about to consider was included under the head of tonsillitis. Fletcher Ingalls,[1] in the last edition of his work, and practically all systemic writers on medicine, still fail to separate the disease from inflammatory processes located in the tonsil, though Ingalls admits that the abscess forms outside the gland itself in at least four-fifths of the cases. Bosworth,[2] however, and laryngologists generally, now usually employ the term of peritonsillar abscess as more correctly describing the condition in the throat. I have retained the old name, quinsy, as leaving the ground open for discussion as to the exact seat of the pus in the most common form of the affection.

Quinsy is not a very rare disease, and in private practice probably the majority of cases are seen in the first instance by

[1] Diseases of the Chest, Throat, and Nasal Cavities, 2d edition, p. 362.

[2] Diseases of the Nose and Throat, vol. ii., p. 125.

the family physician rather than by the specialist in throat diseases, though the aid of the latter may be required later. A severe case of quinsy is never a light matter to the patient. Though of almost uniformly favorably prognosis there is, perhaps, no affection which for a time causes such acute discomfort to the individual affected with it. Most cases result in the formation of pus, and until this is evacuated, either spontaneously or by incision, the patient's misery is extreme. Many practitioners, and even some surgeons, among them Verneuil,[1] have expressed themselves as opposed to instrumental interference. But the general practice at the present day is to give vent to the pus as soon as its situation can be determined. The instantaneous relief given by an opening in the right place is most striking. On the other hand, scarification of the tonsils, as is sometimes recommended, does no good, and usually aggravates the patient's condition. As an illustration, I will narrate briefly a case seen by me last spring. The patient was a servant in a family in my neighborhood, and was under the care of a physician living in a distant part of the city. I was roused in the night and asked to see her at once, her husband telling me that she was in danger of suffocation. I found the patient in great distress, presenting the picture with which you are all familiar. I learned that she had been ill for some three days, and that both tonsils had been repeatedly lanced on the previous day, with the result of simply adding to her discomfort. With some difficulty I succeeded in opening the patient's mouth sufficiently to get a fair view of the interior. Both tonsils were enlarged and red, and showed also a white follicular deposit. The uvula was very œdematous, and the soft palate on the left side was enormously swollen and bulging, and livid red in color. To the finger it felt elastic, with a doubtful sense of fluctuation. After applying a solution of cocaine I made a free incision at a point about midway between the base of the uvula and the last upper molar tooth on the left side. There was at once a gush of pus, with immediate relief to the patient, and in two or three days she was well.

[1] Gazette des Hôpitaux, 1879, p. 162.

I afterward discussed the case with the attending physician. He frankly admitted the good results of the incision through the soft palate, but believed that the operation was attended with the danger of wounding some of the large vessels in the neighborhood. As he is a man of large experience and good judgment, and such danger had never occurred to me, I thought the subject would repay investigation. I have asked the opinions of a number of medical men, including both laryngologists and general practitioners, and their answers have been pretty much to the same effect. The specialists have all said that the abscess is usually situated outside the tonsil, and lies in the anterior or posterior pillar of the palate, or in the palate itself. They believed in giving free vent to the pus wherever found, and were convinced that the operation was attended with no danger if properly performed. The general practitioners were naturally rather less positive in their opinions. They admitted that it was good practice to let out the pus when you were sure where it was, but that it was not always easy to find.

On consulting the literature of the subject I found the most recent authorities agreed as to the location of the suppurative process and the proper point for incision. Chiari,[1] Bosworth,[2] and Shech,[3] state that the inflammation begins in the connective tissue about the tonsil, and usually extends into the soft palate. They advise that the opening should be made at the point I have already indicated, namely, midway between the uvula and the upper alveolar process of the affected side.

Of 32 cases seen by Chiari, in which pus formed, and was evacuated spontaneously or by incision, the point of opening was through the soft palate in 18 cases, through the tonsil in 8, through the posterior faucial pillar in 2, through the anterior pillar in 1, near the ramus of the lower jaw in 2, and in one case the place of discharge was not found.

Bosworth's statistics show that of 132 cases of quinsy the process was located in the soft palate in 115, in the posterior pillar of the fauces in 11, in two cases the abscess developed

[1] Wiener klin. Wochenschrift, 1889, ii. p. 820. [2] Loc. cit.
[3] Diseases of the Mouth, Throat, and Nose, translated by Blaikie, p. 135.

beneath the tonsil, and discharged upon its surface through one of its crypts, and in two cases the posterior wall of the pharynx was involved. In the few cases of which I have notes, seven in number, all seen in private practice during the past three years, the soft palate was uniformly the chief seat of suppuration.

Rice,[1] in a careful study published some two years ago, came to the same conclusions as the above, except that he usually prefers to puncture through the anterior pillar of the fauces.

All of these writers, with the exception of Bosworth, regard the operation as perfectly safe when performed with a good illumination and with care. Bosworth expresses himself as follows: "In making this incision one always bears in mind the proximity of the large bloodvessels of the neck, and the possible danger of wounding them. I have incised the phlegmon in a very large number of cases of quinsy, and in no case have I done it without a certain degree of nervousness on this account; and yet it seems to me that if one recognizes the true pathological condition, and has localized the suppurating point, one ought to feel confidence in the manipulation. When, however, we consider that so great a surgeon as Chassaignac, in operating upon a faucial phlegmon, wounded what was probably the internal carotid artery, necessitating the ligation of the common carotid, it would seem to be an accident that might happen to anyone. Similar instances are reported by Duke and Murphy."

Bosworth's caution would appear to be well founded when we read what the standard anatomists have to say on this point. According to Holden,[2] "The tonsil lies close to the inner side of the internal carotid artery. It is only separated from this vessel by the superior constrictor and the aponeurosis of the pharynx."

Gray[3] also warns us that "the relation of the internal carotid with the tonsil should be especially remembered, as instances

[1] Medical Record, 1891, vol. xxxix. p. 125.
[2] Manual of Dissection of the Human Body, 4th ed., p. 186.
[3] Anatomy, Descriptive and Surgical, p. 464.

have occurred in which the artery has been wounded during the operation of scarifying the tonsil, and fatal hemorrhage has supervened." Quain[1] does not treat of the surgical relations of the artery, but simply states that "it rests on the rectus anticus major muscle, and has the pharynx and tonsil on its inner side." Cruveilhier[2] says, "the relation of the artery with the external surface of the pharynx explains how this vessel may be wounded from the interior of that cavity. Sometimes one of its curves approaches the region of the tonsil; and this may, perhaps, have been the case when the artery has been wounded by an instrument directed transversely outward and carried into the tonsil, either to open an abscess or to excise the gland." Leidy,[3] expresses himself in terms almost identical with those of Quain. Tillaux[4] also asserts that "the tonsil is only separated from the internal carotid by the thickness of the pharyngeal wall," and that "the relations of the artery with the gland should be present to the mind of the surgeon each time that he opens an abscess of the lateral wall of the pharynx."

The views I have just quoted of the relations of the internal carotid artery are the same as those generally taught by lecturers on anatomy of the present day.

The special studies of the laryngologist should, however, lead us to a modification of these views. Delavan[5] was, I believe, the first in this country to question the accuracy of the observations of the older anatomists. As long ago as 1880 he wrote that "the relations of the tonsil to the internal carotid artery are not so intimate as commonly is supposed, for, between the lateral wall of the pharynx, the internal pterygoid, and the upper cervical vertebræ, there is a space filled with cellular tissue, the 'pharyngo-maxillary interspace,' in the posterior part of which are located the large vessels and nerves, and which lies almost directly backward from the pharyngo-palatine arch. The tonsil corresponds to the anterior part of this inter-

1 Elements of Anatomy, 8th edition, vol. i. p. 374.
2 The Anatomy of the Human Body, p. 526.
3 Elementary Treatise on Anatomy, 2d edition, p. 483.
4 Traité d'Anatomie Topographique, p. 353.
5 Archives of Pharyngology, 1880, vol. i. No. 4, p. 339.

space, so that both carotids are behind it, the internal carotid 1.5 centimetre, the external carotid 2 centimetres distant from its lateral periphery. Hence, the danger of direct injury to the internal carotid in excision of the tonsil is infinitely small.

Zuckerkandl[1] also has recently made a most careful study of this region. The drawings made from his dissections show that the pharyngo-maxillary space is divided by the stylo-glossus and the stylo-pharyngeus muscles into an anterior and a posterior chamber. The anterior chamber is contiguous to the tonsil; the posterior chamber contains in its hindermost part the internal carotid artery, the jugular vein, and the vagus nerve. The two chambers are filled with fat and loose cellular tissue, and communicate with each other by a very small opening, which gives passage to the inferior palatine artery.

It is probable, as suggested by Chiari, that the anterior chamber of the pharyngo-maxillary space is alone involved in the great majority of cases of quinsy. The firm wall formed by the muscles described by Zuckerkandl prevents the passage of the pus into the posterior chamber, whereas the tissues of the soft palate yield readily to the advancing inflammation. In rare instances, however, the pus does force its way backward between the stylo-glossus and stylo-pharyngeus muscles, with the results to be indicated later.

The soft palate, through which the evacuating incision is usually made, is distant in adults at least three centimetres from the vertebræ against which lies the internal carotid artery. Even in the child the space is considerable larger relatively than in the adult. I have lately had the opportunity of dissecting a number of newborn infants, and in no case did the distance between the palatal border and the anterior surface of the spinal column measure less than 1.5 centimeter. These measurements apply to the normal pharynx. In the condition we are considering the soft palate is pushed so far forward by the purulent collection that its anterior margin must be nearly double its normal distance from the vertebræ. An incision of even two centi-

[1] Wiener med. Jahrbücher, 1887, vol. v. p. 309.

metres in depth could not, therefore, possibly reach the internal carotid artery. The ascending pharyngeal artery, which has been thought to be wounded in some cases, also lies on the vertebræ, and is, therefore equally out of reach of the knife.

Having apparently shown the impossibility of wounding the carotid artery, what are we to say of the cases alluded to by Bosworth, Gray, and Cruveilhier. I have analyzed every case cited by these writers, and have failed to find one in which the autopsy showed this artery to have been wounded by the knife. In those cases in which no autopsy is recorded it is evident from the clinical history that the bleeding vessel was diseased before the surgeon intervened. Let us first take the cases referred to by Bosworth, those of Chassaignac, Duke, and Murphy.

Chassaignac[1] reported his case to the Surgical Society of Paris. It was that of a man with a fluctuating tumor at the base of the lower jaw on the left side, projecting into the pharynx. There was no pulsation, and Chassaignac made the diagnosis of retro-pharyngeal abscess. An incision was made with no result. A second incision nearer to the median line was followed by a jet of arterial blood. The hemorrhage continued in spite of local pressure and was only checked by ligature of the common carotid. It was a question whether the tumor was an abscess involving the vessels or was an anomaly of the internal carotid. It has apparently escaped the notice of all commentators on this case of Chassaignac, that he reported at another meeting of the same society, some two weeks later, that the tumor still persisted, leaving its nature still more in doubt, whether a phlegmon, an aneurism, or a neoplasm. It is possible, from the location of the incision, that the case was one of abnormally large pharyngeal artery, such as those recently described by Farlow.[2]

Duke's[3] case was that of a man who had received a blow on the side of the head. During the following year he complained

[1] Bull. de Soc. de Chir. de Paris, vol. x. p. 83.
[2] Boston Medical and Surgical Journal, 1890, vol. cxxiii. p. 6.
[3] Lancet, 1848, vol. i. p. 233.

of headaches and sometimes of a rushing sound in the head. He then had symptoms of a sore-throat. Examination showed swelling and inflammation of the right tonsils and fauces, accompanied with difficulty of swallowing and fever. On digital exploration, with the view of incising the supposed abscess, strong pulsation was felt. An aneurismal bruit was also heard behind the angle of the jaw. Duke refused to puncture the swelling, but an incision by a less cautious colleague was followed by free arterial hemorrhage. Ligature of the carotid became necessary and the patient apparently recovered. Five weeks later, in consequence of a journey and the use of spirits, secondary hemorrhage occurred and death resulted. There was no autopsy. The case was supposed by Duke to be one of false aneurism, consequent upon the blow to the head. The editor of the *Lancet*, however, in commenting upon the case, thought it rather a case of abscess caused by the blow, with subsequent communication with the carotid by erosion.

The case narrated by Murphy[1] did not occur in his own practice, but was simply known to him by hearsay, he having been in the neighborhood at the time. The story was as follows: The celebrated Irish surgeon, Cusack, of Dublin, was shooting with friends on the bogs of Tipperary. A woman suffering from tonsillar abscess was brought to him. He plunged his lancet into the tonsil and she died of hemorrhage in five minutes. There was no autopsy, as the surgeon was obliged to run for his life. It was thought at the time (fifty years ago) that the internal carotid artery had been wounded. In the light of our present knowledge it is more probable that the hemorrhage was due to previous ulceration of the carotid or was from the tonsillar artery, as in the following case of Stanley.

Stanley's[2] case is very instructive, the clinical history being supplemented by an autopsy. The patient, a man, twenty-four years of age, entered St. Bartholomew's Hospital, bleeding slightly from the left tonsil. The tonsil was the seat of an

[1] Albany Medical Annals, 1888, vol. ix. p. 78.
[2] Lancet, 1859, vol. ii, p. 509, and 1860, vol. i. p. 35.

abscess which had been punctured by a surgeon in attendance outside the hospital. The hemorrhage recurred from time to time during the next three days, then became profuse, necessitating the ligature of the common carotid artery. The patient did well for eight weeks, then died suddenly from acute softening of the brain. It had been supposed that the internal carotid artery had been wounded, but the autopsy revealed a wound of the tonsillar artery and not of the carotid. Had a correct diagnosis of the condition been made in the case, the hemorrhage might have been checked by pressure over the tonsil, or, at all events, by ligature of the external carotid instead of the much more serious operation that was resorted to.

The above cases comprise all those I have been able to find recorded in which excessive hemorrhage has followed incision of an abscess in or about the tonsil. And in no one of them was it proved that the internal carotid artery was wounded by the knife of the surgeon. But there is another danger to be considered on operating on a phlegmon of the fauces, which has been alluded to in the histories of the cases of Duke and Murphy. A number of instances have been reported of fatal hemorrhage in quinsy, in which autopsy showed an eroded or ruptured artery, generally the internal carotid. Both Bosworth[1] and Chiari[2] mention the occurrence of this accident, but neither one connects it with the operative interference of the attending surgeon. And yet it is the evacuation of the abscess into the pharnyx, whether spontaneously or by incision, that causes the rupture of the weakened walls of the artery, or allows free escape of the blood already outside of the vessel, but pent up in the pharyngo-maxillary space.

It has long been held by surgeons that the walls of arteries are proof against the destructive action of pus, so that even prolonged contact with it does not cause perforation of the vessel, unless there be local mechanical irritation, as from a drainage-tube or a bony sequestrum. When Liston[3] reported his celebrated case of spontaneous perforation of the common

[1] Loc. cit. [2] Loc. cit.
[3] On a Variety of False Aneurism, 8vo, pp. 39. J. Palmer, London.

carotid artery fifty years ago, the London Medical and Surgical Society refused to incorporate it in their *Transactions*, and he was obliged to publish it at his own expense. Since that time, however, other cases, equally striking, have been recorded, and it can no longer be doubted that spontaneous ulceration of arteries does occur simply from the corrosive action of pus.

Monod,[1] in an interesting study of this question, made a collection of eighty-eight cases of erosion of arteries, including six in which the carotid was the vessel involved as a complication of quinsy. Vergély[2] adds ten cases of perforation of the carotid to Monod's list, one of the cases being from his own practice. Four of Vergély's cases are not strictly instances of acute suppuration in the tonsillar region, hence I have excluded them. I have, however, found eight additional cases[3] in the literature of the subject, making a total of twenty in all. All of these were cases of acute faucial phlegmon. The only doubtful one in the series is that of Duke, in which the long duration of the symptoms and the history of trauma complicate the question somewhat.

It is not necessary to give all these cases in detail, as they resemble each other very closely. In 18 the opening was spontaneous, occurring in 3 cases on the third day of the disease, in 4 on the eighth, and in 1 as late as the twelfth day. The 2 cases, those of Duke and Murphy, in which the hemorrhage followed upon operative interference, have already been given above. The common carotid artery was ligated in 7 cases, 4 of which recovered, the other 3 dying of secondary hemorrhage or of cerebral softening. Of the 13 patients in whom the carotid was not tied, all died but one. He was apparently saved by syncope, though the hemorrhage was supposed to have come from the internal carotid artery. Autopsies

[1] Bull. et Mém. de Soc. de Chir. de Paris, 1882, viii. p. 666.

[2] Journ. de Méd. de Bordeaux, 1886, Nos. 49, 50, and 54.

[3] These eight cases are reported by the following observers. Norton: The Throat and Larynx, London, 1875, p. 12. Müller: Bull. gén. de Thér., 1885, vol. xlviii. p. 517. Weinlechner: Wiener med. Blätter, 1885, vol. viii. p. 1623. Moizard: Journ. de Méd. et de Chir. prat., 1886, vol. lviii. p. 347. Postemski: Gaz. de Med. di Roma, 1887, Feb. 15. J. N. Hall: Boston Medical and Surgical Journal, 1887, vol. cxvii. p. 604. Murphy: Loc. cit. Dunn: Univ. Med. Mag., 1890 and 1891, vol. iii. p. 455.

were obtained in 8 of the 20 cases, showing perforation of the internal carotid artery in 5. The source of the hemorrhage proved to be the internal maxillary in one case, a branch of the external carotid in one case, and the tonsillar artery in one case.

In the fatal cases without autopsy, and in the cases which recovered, the hemorrhage was attributed to the internal carotid in all but one. In that case the ascending pharyngeal artery was thought to be the vessel involved, but upon what grounds does not appear in the history. It may be well to give brief details of two of the most striking cases in which the diagnosis was verified by autopsy.

The first case is that of a man, forty-four years of age, of previous good health, whose symptoms were those of ordinary acute sore-throat. Müller,[1] who reports the case, first saw the patient on the seventh day of his illness. There had been great swelling in the region of the left tonsil, but no fever, and little pain, except on swallowing. The patient had expectorated a little blood mingled with pus. The treatment consisted simply of cataplasms and cold drinks. The hemorrhage increased in amount, and the patient died on the following day. On autopsy an abscess cavity was found in the left tonsil, and at the bottom of the deep cavity, filled with clotted blood, was the internal maxillary artery, its walls thinned and ulcerated. The carotid and other vessels were normal. It would seem that local pressure, had it been employed, might have checked the hemorrhage in this case.

The second case is that reported by Vergely[2] in 1886. A man, thirty-four years of age, was taken sick on July 26th, and entered the hospital on the 30th. The pharynx, palate, and faucial pillars were intensely red. On the left side there was swelling of the soft palate and anterior pillar, and projection of the tonsil. There was great resistance everywhere to the finger, no fluctuating point could be felt, nor any pulsation. The pain and swelling extended from the back of the throat to the angle of the jaw, and later to the mastoid region and below

[1] Loc. cit. [2] Loc. cit.

the hyoid. The patient was pale and prostrated. Surgical treatment was deferred for the development of fluctuation. On July 31st the symptoms were worse, but there were still no signs of pointing of pus. On August 1st the condition was the same. The tonsil and adjacent parts were of a dark red color. Vergely was about to puncture the tonsil when the patient showed a little expectoration of mingled pus and blood. The operation was then again deferred to the next day, but in the afternoon the patient died with a sudden profuse hemorrhage. On autopsy no suppuration was found in the tonsil or pillars, but behind, in a little retro-tonsillar pocket, were some large black clots and bits of necrotic cellular tissue. The internal carotid artery was cut in two about two centimeters above its origin. The upper end of the vessel was not found.

In this case, as in two others of our series, the operation had been deferred for a day or a few hours and the surgeon thus escaped the charge of having precipitated the hemorrhage. But, on the other hand, had the incision been made early, without waiting for signs of fluctuation, the ulceration of the artery might have been prevented and the life of the patient saved.

In seeking an explanation of the spontaneous rupture of the carotid artery in phlegmonous inflammation of the throat, it has been suggested that there must be present some general constitutional dyscrasia, or perhaps an impaired state of the walls of the vessel, due to previous attacks of inflammation in its neighborhood. In only four of our cases was there any such cause for the accident. Two patients were suffering from scarlet fever when the throat affection began, and a third was said to be subject to abscess of the tonsil. In Duke's case the blow on the head was undoubtedly a most important etiological factor.

Vergely[1] believes that the vicinity of the air-passages is the great local exciting cause of the accident. Micro-organisms and foul gases are constantly inspired and expired, and may easily give a septic character to the pus in the neighborhood.

[1] Loc. cit.

According to Verneuil,[1] the outer arterial coat becomes thickened in an abscess cavity, if neither fever nor septicæmia occurs. But if these complications arise, the protecting cover disappears and the artery is denuded. In angina the pus and gases confined in the pharyngo-maxillary space kill the arterial wall before compensatory hypertrophy has time to take place. Probably the septic character of the pus, combined with pressure, are the important agents in eroding the artery. Hence the supreme importance of relieving the tension of the parts, even if suppuration has not yet taken place. Bosworth[2] tells us that we may expect the formation of pus by the end of the second or on the third day. In protracted cases, lasting ten days or two weeks, suppuration is not delayed, but the abscess is probably deeply seated in dense tissue and approaches the surface slowly.

I have already said that the hemorrhage occurred in three of our cases on the third day, so that the accident could hardly have been anticipated. It should be noted that in two of these cases scarlet fever had been present for a week or more, which may account for the rapid yielding of the arterial walls.

It is rather remarkable that the great majority of the patients were men. The sex is noted in sixteen cases, and of these twelve were male, one was female, and three were very young children. This preponderance of the male sex naturally suggests syphilis as an etiological factor, but this disease is not mentioned by any observer.

Conclusions.—1. In quinsy, the inflammatory process is usually situated without, and not within, the tonsil. 2. If pus forms it should be evacuated at the earliest possible moment. 3. Unless there are signs of pointing elsewhere, the incision should be made through the soft palate directly backward. 4. If the tension of the parts is very great the incision is indicated, even though pus has not formed. 5. If ordinary surgical care is exercised there is no danger of wounding the internal carotid artery. 6. In cases of deep-seated inflammation, in which the

[1] Bul. de Soc. de Chir., 1888. p. 740.

[2] Loc. cit., p. 116.

pus comes to the surface slowly, erosion of the arteries in the neighborhood may take place. In such cases, therefore, we must be ready to deal with arterial hemorrhage at the moment the abscess discharges into the pharynx.

DISCUSSION.

Dr. Allen: I have listened to this scholarly paper with interest. My position, as one chiefly interested in laryngological medicine, perhaps unfits me to comment upon it as it deserves. A physician who is identified with special lines is liable to see peculiar cases, and thus be misled.

I have often been asked to see cases of tonsillitis where the region of which Dr. Brannan speaks has been fairly riddled with knife-punctures. The attending physician has applied the rule and not found pus; and the next day makes another puncture, and when, perhaps, the family becoming first anxious and then demoralized, make a change in medical advisers, and then the newly-arrived practitioner has an opportunity of seeing how often pus is found *in* the tonsil, not *outside* it. If we remember that the tonsil is a lymphoid mass, we have a right to expect pus to be often formed outside, as in inguinal bubo. We should, as a rule, look for it *outside*, but when we state that it is rarely within the gland, we make mistakes. I recall an example, where being, as I may say, fortunately placed, I knew the pus was not in the region of selection. I explored the tonsil, and pus escaped from a crypt, thus showing that in exceptional cases we may have pus form in a crypt, which is so dense and surrounded by neighboring tissues that it cannot escape, but the simple introduction of a curved probe enables it to flow out.

A vessel large enough to cause death by hemorrhage has been wounded in tonsillotomy. This has occurred at the hands of competent surgeons.

I recall the case of a lady who had the ordinary symptoms of purulent tonsillitis, and I was asked to see her with the attending physician, to decide as to the propriety of making an incision. After seeing the case, I called him to one side, and told him I did not see the use of making an incision, and that I did not think there was any pus present. We waited. He went out of town, and I had to assume the responsibility. I made that lady visits, morning and evening, for several days, anxiously waiting for signs that would warrant the making of incisions. There were none. She got steadily worse. I then had in

mind one of those cases the speaker alludes to—the possibility of the pus not pointing toward the pharynx. Still that could not be proved. The swelling of the pharynx and palate was uniform; there was no pointing, nor was there any condition indicating the presence of pus at the point of selection. And yet being urged to do something, I opened the tonsil freely in two places, until I was convinced that I was at the bottom of the gland. No pus escaped. I was very anxious; the family were demoralized; and I was almost so, when, without any cause, the lady slowly and gradually got better (certainly without pus escaping either night or day), and made a satisfactory recovery.

I mention this case in illustration of the obscurities sometimes attending the treatment of tonsillitis. Patients will recover without incision; and in others, unless we make an early incision, we feel as though we were not doing our duty. The line between these two extremes depends on the study of each case. The immense range of peculiarities that occur in this condition (as I believe, above all other conditions) make it most difficult to formulate general expressions which can assist the practitioner.

Dr. Jacobi: I do not think it is so valuable to generalize on these conditions. The Doctor has stated the abscesses of which he speaks are not in the tonsils; and also that they are not the common cases of retro or lateral pharyngeal abscesses, but peritonsillar abscesses; and the only thing I object to is the name.

When we speak of phlegmonous angina we are in danger of assuming under that name all found in that neighborhood. When he speaks of phlegmonous angina, I don't know where that is. He emphasizes peritonsillar abscess; it is true they are a little more frequent than we usually think. They are seen, and that appears not to be commonly known, in infectious disease. Some local infection must take place in every case, it is true, but the genuine so-called infectious diseases appear to promote them. The usual opinion is that in diphtheria no abscesses are found, and still there is this very kind of abscess behind the tonsils that is sometimes found in diphtheria; they are the worse and most torturing cases. Where the diphtheritic membrane is but thin, and there is a great deal of swelling behind the tonsils, it is often found to be the result of local abscess.

As far as the abscesses in that neighborhood are concerned, I know a great many of them are really tonsillar. We must not forget how easily they may return. We know abscesses in the tonsils may take place once or twice a year in a number of persons. I know quite a number, particularly children or adolescents, who had an abscess once a year at least. How is this possible? Simply because the tonsil is not one body, but a conglomerate of nine or ten bodies, bound to each other with a good deal of elastic tissue, each with a crypt or lacuna. Every one of them may become the seat of an inflammation and sup-

puration. The more frequently the tonsil, or part of it, has been inflamed the deeper the lacunæ become, the more easily obstructed. Abscesses in them are common; they become very large, very painful, and complicated with a great deal of fever, which will be removed only by free incision.

The large majority of abscesses in the throat in adolescents are of the latter kind, and a large number are retro-, or latero-pharyngeal abscesses. To diagnosticate a latero-pharyngeal abscess from the Doctor's peritonsillar abscess is not always an easy matter.

Dr. L. Weber: In my comments on this paper I have no remarks to make with regard to extraordinary cases, though I have seen quite a large number of acute peritonsillar abscesses, more in adults than in children. I may say that quite a number of cases of peritonsillitis get well without forming abscesses. In those cases in which abscesses are formed it generally, according to my experience, takes at least three days, sometimes longer, before pus can be found and safely evacuated, or before Nature herself makes an opening, which is rather often the case. I take it almost as often as the gum-boil burst, the peritonsillar abscess of the ordinary kind will open by Nature's own efforts.

The difficulty in dealing surgically with these acute abscesses is that it is exceedingly difficult to establish by manual examination, one hand on the neck of the patient and the other in the throat, distinct fluctuation. The tenderness is such that a thorough examination in this region is not as satisfactorily and easily made as in other regions; and it is difficult to establish the precise locality of the fluctuation, if at all. I have, therefore, made it a rule from the third day on, if the suffering is very acute, to take a lancet-shaped needle, mounted on a long staff, and never going deeper than one centimetre, if as deep, explore the locality where pus will most likely be found.

In one-half of the cases I have seen Nature points the way in showing a little discolored spot, which instead of looking intensely red, is yellowish-red; and if you thrust the lancet in you will most likely find pus. Finding pus, I would not open with a bistoury or lancet, but with a knife, such as may also be conveniently used in opening gum-boils; it has a hatchet-shaped cutting edge with rounded points and pretty heavy shoulder. The cutting edge is about one centimetre in length, and the same in depth, so, that if you plunge it into an abscess, it cannot enter more than one centimetre from the surface.

It is not the province of the general practitioner to cut deeper in any such cases; and I doubt whether a surgeon will generally care to go much deeper.

I have not been so unfortunate yet as to meet with a case of arterial hemorrhage in opening abscesses of that kind.

As has been mentioned by another speaker, it not infrequently

happens that we do not succeed in finding the abscess, and on calling the next day, find that Nature had made an opening. The abscess I am speaking of I almost always opened to the inner side of the tonsil, through the mucous membrane of the palate about one centimetre from the edge of the tonsillar pillar. Not once have I had occasion to cut through the tonsil, so far as I now remember. I am of the opinion that the majority of these cases are really peritonsillar abscesses. In nearly all of the cases tonsillitis of the ordinary kind preceded the infection that led to the formation of the purulent gathering next the tonsil.

In summing up my experience, then, I would say, that quite a large number, perhaps one-half of the cases of peritonsillar abscess that I have seen, have opened by themselves, without any detriment generally or locally, and to the great relief of the patient. In a number of them where I operated I had considerable difficulty in finding pus, and when found after several fruitless searches, wherever I did cut it was to the side of the tonsil in the palatal arch, and not in the tonsil itself.

Among the many cases of peritonsillitis I have seen I saw one last winter which bore a great resemblance to the case mentioned by Dr. Allen, where there was intense suffering for two weeks, and where in spite of searching, as I did, and as others had done before me, no pus was found, nor did any abscess appear, but recovery occurred by slow resolution.

Dr. Reed: One practical point in the treatment of these cases, and that is the inhalation of hot vapor to soften the surface and help the opening of the tonsillar abscess. I know in surgery poultices have gone out of favor, the theory being to open early and let out the pus; but we cannot always find pus; and I find that this helps very much. It prevents opening in the wrong place.

Dr. Brannan: These cases always give me a great deal of anxiety in their grave form. I wanted to formulate some rules for the general practitioner, which would aid him in looking for the trouble. Of course, we do find pus in the tonsil. I wish to lay special stress on the bad practice of puncturing and cutting the tonsils, as I have seen done. I have one patient who sends for me once or twice during the winter, and I find each time the throat enormously swollen. They won't let me do anything. I look at it, prescribe, and when I go the next morning I find that it has ruptured in the usual place. The reason they won't permit anything to be done is probably because they have had some such experience.

In my conclusions I stated that unless the indications pointed elsewhere, I should prefer this point of incision for the ordinary cases.

As to the depth of the incision, I never put in the knife myself

more than two cm. I take the ordinary bistoury and wrap to within one-fourth inch of the point; and in the cases I have seen this suffices to reach the pus; but in talking with friends in New York, where this was discussed informally, two speakers related that they had put in the bistoury to the depth nearly of one inch, and it was only then that they could relieve the patient, letting out the pus and necrotic tissue.

A CONTRIBUTION TO THE TREATMENT OF PULMONARY TUBERCULOSIS WITH PROFESSOR KOCH'S TUBERCULIN.

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REPORTS of cases showing the results of any particular procedure in therapeutics, made immediately or within a short time after their application, are current in medical literature, and, while they may throw light upon the utility or otherwise of the treatment employed, it is not to be doubted that many such reports would require modification, indeed, might show the reverse of the conclusions first arrived at, if a longer time had intervened by which the permanency of the results or the final issue of the cases could have been established. We are the more ready with our reports if our work has been apparently successful, or if the medical or surgical procedure is new and is attracting attention at the time. But if hasty reports and conclusions were ever offered, it certainly was the case with the effects of Professor Koch's tuberculin; indeed, in many instances, a few weeks of experimental employment of the remedy was deemed sufficient for enthusiastic recommendations or for absolute condemnation.

It is now two years since I wrote my report of my first twenty-five cases treated with Koch's tuberculin, which report was presented to the American Medical Association at Washington on May 7, 1891, and subsequently published in the *Therapeutic Gazette* for June 15 of the same year. In making the report it was my earnest endeavor to be conservative, and I purposely published with it the detailed history and all

important data in connection with the treatment of each case, so that the reader might be able to judge for himself the benefit each patient had derived. The cases were divided into three classes.

CLASS A.—*Five cases* who had one or both upper lobes involved, but without destructive changes, the general health of the patient being still comparatively good.

CLASS B.—*Seven cases* with more extensive disease or moderate destructive processes, but still in a fair physical condition.

CLASS C.—*Thirteen cases* still further advanced in local disease, with considerable constitutional impairment, but still in condition justifying some hope for improvement.

I concluded that report with the following remarks: "First, that according to my experience, with the patient under constant medical supervision, and under the precautions used, the remedy *can* be given with the avoidance of all unpleasant symptoms or danger; second, that, while I believe that I have derived material benefit, the experience of many additional observers under *a similar mode of management and administration to that adopted by myself* is required to establish the exact value and range of applicability of the remedy; and, third, that the combined means by which my results were obtained appear to deserve the favorable consideration of the profession."

It is now my purpose to show the outcome of those twenty-five cases two years later, as a supplement to my first report, with such explanatory remarks as may be essential for each individual case. To this end careful inquiry has recently been made as to the present condition of these patients.

CASE I., *Class C,* was reported as slightly improved when the treatment was discontinued, on March 11, 1891.

This patient showed further improvement after the discontinuance of the remedy, and remained in the institution for nearly fifteen months thereafter. Under a course of Liebreich's cantharidine the larynx made remarkable improvement, the ulceration of the epiglottis healed, and the infiltration disappeared almost entirely, and sufficiently so to result in the complete restoration of the voice, which had been lost for over

two years. Her nutrition also improved. In March, 1892, active changes again recurred in the lungs, which were accompanied by the usual symptoms of fever, increased cough and expectoration, and loss of flesh. The larynx remained unaffected. All these symptoms subsided under a second course of tuberculin—thirteen injections from one-tenth to one milligramme—and the patient left the institution in May, 1892, greatly improved. At this writing a relapse of her lung affection of recent date has come to my knowledge.

CASE II., *Class B*, was reported as apparently cured. This patient has remained well to this date, and is entirely free from all symptoms. In April, 1892, he had an attack of la grippe, with an intense bronchitis of one week's duration, from which he made a prompt and perfect recovery.

An affection of the respiratory organs like la grippe may be looked upon as a rather crucial test of the permanency of recovery, and the frequency with which we note active symptoms to supervene in latent tuberculosis in connection with la grippe is well known to every practitioner.

The sputum during the existence of the acute bronchitis in connection with la grippe contained no bacilli.

CASE III., *Class A*, reported as improved, has made an entire recovery, and has since remained free from all symptoms.

CASE IV., *Class C*, was reported as improved and the laryngeal disease cured. This patient was still further improved, returned home, relapsed as to her lung affection, and died in July, 1892. The result as to the larynx was permanent until death.

CASE V., *Class C*, reported as not improved, died in 1891.

CASE VI., *Class C*, reported as not improved, died in 1891.

CASE VII., *Class A*, reported as cured, has continued free from all symptoms, and is entirely well at the present time.

CASE VIII., *Class B*, reported as apparently recovered, returned home in May and relapsed in the fall of 1891. He was again treated with tuberculin in the winter of 1891–1892, and was again materially improved, but not to the same degree as in the first course of treatment. He is free from fever, but

coughs and expectorates. His general health is fair. He is still greatly improved as compared with his condition before his first treatment.

CASE IX., *Class A*, was reported as apparently cured. He has remained entirely free from all symptoms to the present time, and is enjoying perfect health.

CASE X., *Class B*, reported as greatly improved, returned home in May, 1891. His improvement has not only continued to the present time, but I have recently been informed of his entire recovery without further treatment.

CASE XI., *Class B*, reported as apparently recovered, has been free from all symptoms to the present time, and is entirely well.

CASE XII., *Class C*, reported as improved, relapsed, and died in 1891.

CASE XIII., *Class C*, reported as improved, relapsed in 1892, and died since.

CASE XIV., *Class C*, reported as greatly improved. No recent report obtainable. He continued in his improvement to the date when last heard from.

CASE XV., *Class C*, reported as greatly improved, died 1891.

CASE XVI., *Class A*, reported as apparently recovered, has remained entirely free from all symptoms, and is perfectly well at the present time.

CASE XVII., *Class C*, reported as improved, continued so when last heard from, in November, 1892. No response to my recent inquiry.

CASE XVIII., *Class C*, reported as greatly improved, continued so when last heard from. No recent report obtainable.

CASE XIX., *Class C*, reported as improved, relapsed, and died in 1891.

CASE XX., *Class B*, reported greatly improved. According to recent information has entirely recovered without resorting to further treatment.

CASE XXI., *Class C*, reported as improved, is about the same at the present time.

Case XXII., *Class B*, reported as improved, has entirely recovered.

Case XXIII., *Class B*, reported as apparently recovered, has continued in good health, free from all symptoms, to the present time.

Case XXIV., *Class A*, reported as greatly improved, has entirely recovered, and is free from all symptoms.

Case XXV., *Class C*, reported as improved, obtained still further improvement. He subsequently relapsed, but improved again, and is now free from all active symptoms.

We find, therefore, that I reported in 1891, in the early stage, five cases treated, three of which were believed to have apparently recovered, one to have been greatly improved, and one to have been improved; all of which have made an ultimate recovery, no relapse having occurred in two years.

In the more advanced stage, Class B, I reported seven cases treated, four of which were thought to have apparently recovered, two to be greatly improved, and one improved. Of these seven cases we find six to have made a final recovery, and to be well two years later, while one relapsed and is again improved.

This gives us for the early stage one-hundred per cent. recoveries, and for the middle stage eighty-six per cent. of recoveries and fourteen per. cent. of improvements, without a death in two years.

In the far-advanced stage of Class C I reported thirteen cases treated, four of which were greatly, six moderately, and one slightly improved; two had made no improvement. Of these cases are still alive six, three of which have continued greatly improved and three others improved, while seven have died.

As to the share attributable to the treatment with tuberculin in obtaining these results, I am still and always shall be unable to mathematically demonstrate it. Every thoughtful reader who is free from prejudice must, however, admit that these results are such as have never been obtained by any mode or combination of treatment heretofore known.

In a paper upon the "Prognosis in Pulmonary Tubercu-

losis," published in the *Medical News*, September 13, 1890, I reported eighty-one early-stage cases corresponding to Class A, of which a subsequent inquiry similar to the present one showed twenty-four per cent. of recoveries and twenty-one per cent. of improvements. In the more advanced second and third stages four hundred and thirty-four cases were treated, nine per cent. had recovered, while eleven per cent. were still improved. While a similarly large number of my cases treated with tuberculin might have shown the present results modified, yet it cannot be conceived that such a difference as this would be possible.

That it does not exist is, however, amply proved by my subsequent experience with an increased number of cases treated with tuberculin with equally good results, and which I shall report in a future paper.

It has been urged that the results obtained by me with tuberculin are not attributable to the remedy, but to the favorable climate and the correct management of the patients in a special institution where this work was done. If this were so, why have I never before been able to accomplish results even half as good under the same conditions? Why have other patients failed to improve and recover who, either on account of individual prejudice or that o their home physicians, have not received this remedy, and who were treated with every possible care during the same time, in the same institution, and with the same advantages?

Why, then, it will be asked, is it that others have failed to acomplish such results, or, on the contrary, have testified to the injurious effects of the remedy with many of their patients? I anticipate this question because I have been asked it before by medical friends who have visited my sanitarium and satisfied themselves of my results.

In answering it I must first of all call attention to the fact that, with a few exceptions, the administration of tuberculin, both in Europe and in this country, has been upon the original mode first proposed by Dr. Koch.

For those who do not remember it, I may add that the

beginning dose recommended by him was one milligramme or more, and that the remedy was rapidly pushed in increasing doses to one-hundred or even more milligrammes.

This maximum dose was attempted to be reached in a month or six weeks, but the patients were so completely debilitated by fever and constitutional reaction that the more prudent experimenter pursued a somewhat slower course, and the blind followers were overtaken by dismay and disaster in the acute processes induced with the remedy given in such excessive doses.

In this connection we should also remember that Dr. Koch's first experiments were upon early-stage cases, which were physically able to bear even a severe fever reaction, and who happened to suffer no material harm, and that the cases treated were but few when the remedy was given to the profession.

Under this plan of administration the results in early-stage cases were gratifying as compared with other modes of treatment, and, in a truly early stage, all other experimenters have seen equally good results with his own. Only in such early-stage cases did he recommend the use of the remedy, and, had it been confined to such, its utility would never have been questioned. The disasters occurred chiefly in the more advanced stages, and, under the great expectations current at that time, patients both in Germany and in this country, manifestly within a few weeks of their death, received tuberculin injections, and in quantities which by their local and constitutional effects several times caused immediate death.

In the earlier stages, too, it was found that unfavorable effects were occasionally induced from the large doses given, but these bad effects were the more uniform as the treatment was applied to patients whose general health and strength had been more and more impaired during the course and advance of the disease.

Such application of the remedy had never been contemplated by Professor Koch, and all for which I blame him is that he permitted it in the hospitals of Berlin and became aware of it through the literature of the profession elsewhere without entering his protest.

Remembering, however, that he is not a practising physician, that all treatment of cases was carried out by his colleagues, and that he himself possesses no recent clinical experiences in the treatment of consumption or any other disease, it must at this time seem strange that no one for some time dared to depart from the original dosage based upon half a dozen cases, only two of which were then said to have apparently recovered.

With the greatest admiration for Dr. Koch and his labors, this appeared to me ludicrous nevertheless, and when I mentioned my convictions to one of the hospital chiefs in Berlin, he reproved me as though I had committed the "unpardonable sin." "Would you instruct the master?" said he, in utter astonishment.

All those who after their first disappointment did not throw the remedy overboard have since, at least in part, adopted my method of administration, and I believe that I have been the first on either side of the water to enter a protest against its use as originally employed. Since that time excellent results have been obtained from minute and slowly increasing doses by others, some of which I cited in a paper published in the *Southern Medical Record* for September, 1891, and my own results have continued as favorable as ever under this method adopted by me within the first few weeks of its use.

The most recent report of Dr. Thorner, presented to the *Verein für Innere Medicin* on March 8 of this year, on his two years' use of Professor Koch's tuberculin, and which is highly favorable to the remedy, shows that he begins with one-twentieth of a milligramme, and increases about as I do. Under such doses he never saw any unfavorable effect. He emphasizes that the secret in its successful employment is the proper application of the remedy.

But the proper selection of cases is also important, and no patient is suitable for treatment with tuberculin who, at the time, presents symptoms of acute inflammatory changes in tubercular areas or evidence of septic infection.

For such other modes of treatment must be resorted to, by which these symptoms are first controlled; but with these

exceptions patients in any stage where the disease is still confined to the lungs and throat are eligible to the treatment.

The treatment should be carried out in a special institution or hospital, where alone sufficient control and oversight are possible. It certainly must not be delegated to junior assistants, or to physicians who do not possess large experience in the treatment and management of cases of pulmonary and laryngeal tuberculosis. Close observation is indispensable.

A week's observation of local and general symptoms, fully recorded at frequent intervals, must precede the use of the remedy to assure the absence of contraindications.

A physical examination of the chest must precede and follow each dose given, the results of which to the minutest changes observed, should be carefully recorded upon a diagram for comparison.

The difference between a local and general reaction must be clearly understood. The former consists in an increase of the local auscultatory phenomena, with or without slight increase in cough, or a sensation of fulness in the tubercular area of the lung. In the larynx we can observe increased vascularity, sometimes slight swelling, and always increase of the secretions; frequently a sense of fulness in the throat is spoken of by patients.

Any effect beyond this is undesirable, and can be avoided if enough interest is taken in watching the case.

A general reaction, on the other hand, shows, in addition to the local effect, rise in temperature, increase in pulse-rate, shortness of breath, sometimes nausea, vomiting, and diarrhœa. Those symptoms if well marked, are signs of positive danger, and repetition of the dose which produced them, or an increase of the dose, is almost sure to be followed by relapse.

No dose should be repeated until the effect from the previous dose has subsided, and then not until after twenty-four hours.

If the local reaction has been well marked or prolonged a return to the dose which had previously been inoperative is required, and the increase must thereafter be the same as would have been had a larger dose never been given. The same

would, of course, be the more true if general symptoms have been produced.

The reaction occurs, as a rule, in from six to eight hours; I have, however, seen it as early as three hours and as late as thirty-one hours after a given dose; this must be borne in mind, and frequent examinations, especially in the beginning of the treatment, are necessary, so that the effect may be recognized. The duration of the reaction is, as a rule, about six hours, if only local; if general, it may last twelve to twenty-four hours and longer. I have found that the same patient reacts, as a rule, within about the same limit of time.

A certain dose having been given without reaction following, this same dose is nevertheless to be repeated once before an increase is permissible. If a too severe local or general reaction is observed, the patient must be put to bed, and kept perfectly at rest until the reaction has entirely subsided.

Beginning with one-twentieth of a milligramme as a trial dose, to which I have never seen a response, the next dose is one-tenth of a milligramme, and the increase is thereafter one-tenth until one whole milligramme is reached; then I increase one-fifth of a milligramme until two milligrammes are reached; next one-half milligramme up to ten; from ten to twenty milligrammes I increase two and one-half milligrammes, and thereafter five milligrammes at a time.

Periods will be observed when for weeks together no local or general reaction is noted, while the subjective and objective improvement of the patient progresses favorably; and whenever a point has been reached where this improvement is radical, this is the time to stop the use of the remedy, regardless of the dose reached, allowing an intermission of from two weeks to a month.

If no relapse has occurred in this time, if everything is highly satisfactory, and the recovery is apparent, we keep the patient under observation as long as possible, otherwise a repetition of the treatment is, of course, necessary.

In the second course we begin with one-tenth of a milligramme, but increase after each dose so long as no local reaction is produced. My results have been obtained upon this

plan; and while other plans may also be safe and accomplish good results, and while some one may devise even a better plan, until better results than mine are shown by others no change from this mode of administration should be made.

I have thus treated over one hundred patients with between six and seven thousand injections, and, with the exception of my first week or two of experimental use, I have never produced any effect which has in any way been undesirable, nor has there been one single case in which the treatment caused discomfort. I have not found any advantage from Hunter's modification, and am of the opinion that it is in no wise safe to increase it faster than the original tuberculin.

He who cannot have his patients under close and constant observation, or who gives the remedy with less care, simply takes chances, and if no disaster follows, it is good luck, nothing more.

If my precautions and methods in the use of tuberculin are then really essential for good results, as I have found them to be, and which riper experience of two years or more of other observers seems to confirm, we must not blame the remedy if it failed to come up to our expectations under its erroneous use in unsuitable cases and in excessive and highly dangerous doses; we should the less criticise it when the results were unsatisfactory in the hands of men with little experience in close physical diagnosis and in the management of the disease, some of whom dealt out their doses at their office hours without again seeing their patient until he came for his next dose, or until the physician was summoned to find how ill an overdose had made his patient.

In my previous writings on tuberculin I have been exceedingly careful not to commit myself too far; I am now ready to stand by the remedy, not in recommending it as a cure-all, or under all conditions of the disease, but certainly as a remedy of the greatest value when used and restricted as indicated in this paper. With me tuberculin is no longer on trial as an experiment. On the contrary, I find its effects as reliable and as uniform as I could expect them to be under the great variety of individual conditions, such as constitution, stage of the disease, organs involved, or complications present.

A CLINICAL STUDY OF THE USE OF CRUDE TUBERCULIN AND MODIFICATIONS OF THE LYMPH IN THE ADIRONDACK COTTAGE SANITARIUM.

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So little is heard nowadays of this remedy which it is now the writer's purpose of bringing to your attention, that it is with some hesitancy that he submits the following record of the use of tuberculinum purum and other modifications of the lymph during the past two years in the Adirondack Cottage Sanitarium.

His only excuse is that it may serve to stimulate further research in the treatment of a disease which ravages the greater portion of the human race and brings pain and sorrow into so many thousands of families.

Koch's tuberculin has had its day, and the brilliant sun of hope and expected happiness which rose in the hearts of many afflicted persons has sunk into a darker night of despair and utter hopelessness. Yet there still exist some twilight rays, and here and there is some patient worker who is endeavoring to bring light out of darkness and relief to his fellow-men.

Much has been done by Trudeau in experimental research on animals, and the clinical work in the sanitarium has been wholly under his personal supervision, and it is through his courtesy that the writer is permitted to report these cases.

Many eminent and deep-thinking men have stated that there was some little of good in pure tuberculin, but almost everybody now believes that the dangerous elements more than out-

weigh the beneficial. In its modifications, however, attempts have been made to remove these deleterious products, presumably leaving behind the beneficent properties; and it is with these modifications this paper has to deal chiefly.

Very shortly after Hunter's article[1] appeared, Trudeau secured specimens of his C B and B modified lymph; subsequently he further modified Hunter B, and this is the preparation now in use in this institution. Modification C B was discarded after a very short trial, as its injurious effects on the patients were early manifest; one patient subsequently discharged cured received small doses of C B and later a course of treatment with the other two modifications.

Hunter's and Trudeau's modifications probably vary but little in their composition, and as almost all the cases who took Hunter B subsequently received Trudeau's modification, it would be well to state here that clinically the only difference noted between the two was a tendency to a little more reaction in Hunter's, as evidenced by a somewhat higher range of temperature and as a longer period of time elapsed before tolerance was established. When this was attained there was no apparent difference noted in their effect.

Trudeau's modification retains by precipitation with sulphate of ammonium the albuminoses contained in liquid cultures, as suggested by Hunter, the only difference being that no heat is used in the manufacture of the original tuberculin from which the modification is derived.

In its strength, 10 milligrammes of the modification represents one of the crude tuberculin of Koch.

In tabulating the report of cases for brevity, it would be well to state here that every case had the tubercle bacilli in the sputum at the commencement of the treatment, and that only the gross lesions have been put down as diagnosed by Dr. Trudeau.

In grouping the cases together the following definitions of the three classes are given:

[1] British Medical Journal, July, 1891, No. 1595.

Incipient. Cases in which both physical and rational signs point to but slight local and constitutional involvement.

Advanced. Cases in which the localized disease process is either extensive or in an advanced stage, or where, with a comparatively light amount of pulmonary involvement, the rational signs point to a grave constitutional impairment or to some complication.

Far advanced. Cases in which both the rational and physical signs warrant the term.

Koch's tuberculinum purum:

Four incipient cases: Three (Cases 1, 2, and 4) have stated that they have remained well ever since their discharge, between eighteen and twenty months ago. One (Case 3) has returned, and although the disease has progressed in her case, it has assumed a more limited character than is usually seen, and remains confined to the same lung.

Of five advanced cases, one (Case 8) discharged eight months ago is at work in New York City, and says she is very well; one (Case 9) discharged six months ago is in Denver and at work; two others (Cases 5 and 6) state they are as well as when they left, and at that time their disease was arrested and their condition very good: the fifth (Case 7) has passed from observation.

Of the three far-advanced cases two were hopeless (Cases 10 and 11), are dead, and the third (Case 12) left the sanitarium with the disease quiescent in her lungs, but was suffering from gastric catarrh; since then she has developed diarrhœa, and is probably dead.

With the exception of three cases, all the patients who began with Hunter B received subsequently inoculations of Trudeau's modification. One of these (Case 13), an advanced case, lost the bacilli, and states he is now in good condition, working in New York City and living in Plainfield. The other two, far advanced (Cases 14 and 15), are dead.

Of the eleven who received both forms of the modifications, the two incipient (Cases 16 and 17) lost the bacilli and both have been seen and examined by the writer and remain appar-

ently cured, eight and five months since their discharge; one is at work in New York and the other in Baltimore.

Of the four advanced, one (Case 18) lost the bacilli and her lungs are now in a better condition than they were eight months ago, when she was discharged. Two (Cases 19 and 20) have remained in good condition and are still in the Adirondacks, not having received any lymph for seven and four months respectively; both have the bacilli in sputum. The fourth (Case 21) has just been discharged with the disease arrested.

Of the five far-advanced, three (Cases 24, 25, and 26) were hopeless at the start; in all throat lesions were the most pronounced, and they are now dead. Two others are still under observation, and the arrest of their disease was something which we scarcely dared to even entertain any hope of. One (Case 22), with extensive ulcerations of cord and larynx, nine months after treatment was stopped exhibited the most beautiful cicatrices of very old and serious lesions; the other (Case 23), with two or more cavities and the antecedent history of nearly fatal hemorrhages, never has any temperature and suffers only from the crippled condition of his breathing apparatus.

Trudeau's modification:

Twelve have been treated by this modification alone.

Two incipient cases (27 and 28) are still under treatment, have lost the bacilli, and the lungs show signs of decided improvement. One (Case 29) received treatment less than three weeks, was taken with hemorrhages from violent exercise, developed tubercular pneumonia, and is past recovery.

Of four advanced, one (Case 30) has lost the bacilli for eight months, and the disease is perfectly arrested. One (Case 31) has not retrograded at all, although for months he has been under treatment for compound comminuted fracture of the tibia, where there was necrosis, suppuration, and delayed union; at time of writing he is beginning to walk. One (Case 32) is able to act as nurse in the infirmary, and all her throat symptoms have disappeared. The fourth (Case 33) improved under treatment for four-and-a-half months, the disease then became active and there is no hope of any improvement.

TUBERCULINUM PURUM.

Name and No. of case.	Condition at beginning of treatment.	Feverish or apyretic cases.	Hemorrhages anteced'nt to treatment.	Dose.	Reaction.	Length of treatment.	Weight.	Condition on discharge.	Remarks.
Incipient.									
1. John F. M., 29, German.	Right apex, small area of consolidation.	Apyretic.	Hemorrhage.	0.001 to 0.075	Some reaction at start.	6 mos.	21 lbs. gain.	Disease wholly arrested; tubercle bacilli present.	During treatment extensive pleurisy of right base. Patient writes the tuberbacilli have disappeared from sputum,
2. John N. M., 28, U. S.	Right apex, small area of consolidation; left, scattered tubercles.	Apyretic.	No hemorrhage.	0.001 to 0.100	Slight reaction to first ten doses, then none.	5 mos.	6 lbs.	Disease wholly arrested in right lung; no physical signs in left; tubercle bacilli present.	
3. L. P. G. F., 48, U. S.	Right apex, small area of consolidation.	Apyretic.	No hemorrhage.	0.001 to 0.025	Reaction at first severe, but little fever.	6 mos.	2½ lbs.	Disease arrested; during treatment left apex developed evidence of disease; tubercle bacilli.	
4. M. E. B. F., 30, U. S.	Left apex, behind few nodules; warty prominence in throat.	Apyretic.	No hemorrhage.	0 001 to 0.005	Reaction; swollen gland in neck.	3½ wks.	1 lb.	Condition unimproved; gastric complications; tubercle bacilli present.	Disappeared several months later after going elsewhere.
Advanced.									
5. L. D. S. M., 31, U. S.	Right apex consolidated; œdema and congestion of larynx; no ulceration.	Fever.	Hemorrhage.	0.001 to 0.040	Decided reaction at first, then norm. temp.	3 mos.	15 lbs.	Larynx appears normal and healthy; disease quiescent; tubercle bacilli; no fever.	
6. C. W. G. M., 23, U. S.	Left upper lobe consolidated; right apex, small area of consolidation.	Fever.	Hemorrhage.	0.001 to 0.078	Decided reaction.	3 mos.	11¾ lbs.	Disease arrested; no fever; tubercle bacilli.	
7. D. W. M., 29 German.	Left apex, consolidated; Right apex, small area of consolidation.	Antecedent temp. not noted.	Hemorrhage.	0.001 to 0.100	Slight reaction.	3¾ mos.	30½ lbs.	Apparently cured; no râles in lungs.	Complications, axillary enlargement and arthritis of ankle.
8. M. D. F., 22, U. S.	Left lung, upper third consolidated.	Antecedent temp. not noted.	Hemorrhage.	0.001 to 0.045	Reacted; very susceptible to use of drug.	6 mos.	2½ lbs.	Diseased arrested; tubercle bacilli.	

Name and No. of case.	Condition at beginning of treatment.	Feverish or apyretic cases.	Hemorrhages anteced'nt to treatment.	Dose.	Reaction.	Length of treatment.	Weight.	Condition on discharge.	Remarks.
9. F. G. F., 19, English.	Left apex, consolidated; softening. Right apex, scattered tubercles; pleurisy over base.	Fever.	Hemorrhage.	0.001 to 0.100	Reaction decided; subsequently no fever.	3 treatments, last one with Hunter B.	16 lbs.	Apparently cured; evidences of old pleurisy only remain; no tubercle bacilli.	Slight hemorrhage after first injection of 100 mgs.
Far adv'nc'd.									
10. M. D. F., 40, Irish.	Both apices consolidated; scattered tubercles in right lung.	Fever slight.	Hemorrhage.	0.001 to 0.010	Reaction slight.	3 times a week for 2 months.	5 lbs. lost.	Condition unimproved.	Had been treated with lymph before admission.
11. K. K. F., 30, Irish.	Both apices consolidated; right base, pleurisy.	Fever.	No hemorrhage.	0.001 to 0.005	Reaction slight.	Twice a w'k for 2 mos.	$7\frac{1}{4}$ lbs. gain.	Active disease still exists; tubercle bacilli.	Had been treated with lymph before admission.
12. J. F. F., 23, U. S.	Left lung, large cavity in upper third; right lung, small area of consolidation.	No.	No hemorrhage.	0.001 to 0.075	Slight reaction at first.	8 mos. 4 mos. of treatment with Hunter B. afterwards admin.	5 lbs. lost.	Left lung absolutely quiescent for many weeks before discharge; right apex disease arrested, although at one time a hemorrhage occurred from it.	From the first patient's stomach was in bad condition, and for weeks it was necessary to wash it out.

HUNTER B.

Name and No. of case.	Condition at beginning of treatment.	Feverish or apyretic cases.	Hemorrhages anteced'nt to treatment.	Dose.	Reaction.	Length of treatment.	Weight.	Condition on discharge.	Remarks.
13. W. F. H. M., 24, U. S.	Left apex, consolidated; thickened pleura over base.	Apyretic.	Hemorrhage.	0.005 to 0.350	None.	$5\frac{1}{2}$ mos.	$12\frac{3}{4}$ lbs.	Disease arrested; no tubercle bacilli.	Hard induration on posterior wall of rectum which disappeared without treatment.
14. R. F. S. M., 27, U. S.	Cavities in left lung at apex and in base; right apex, consolidated,	Apyretic.	Hemorrhage.	0.0025 to 0.210	None.	3 mos.	......	Condition unchanged in lungs.	Complications, cirrhosis of liver and kidneys. Died of uræmia.
15. M. S. M., 33, U. S.	Both lungs, consolidated; left base, pleurisy; ulcerations in larynx.	Fever.	Hemorrhage.	0.0025 to 0.070	Reaction marked.	1 mo.	$3\frac{1}{2}$ lbs. lost.	Condition unimproved.	

Hunter B and Trudeau's Modification.

Name and No. of case.	Condition at beginning of treatment.	Feverish or apyretic cases.	Hemorrhages anteced'nt to treatment.	Dose.	Reaction.	Length of treatment.	Weight.	Condition on discharge.	Remarks.
Incipient.									
16. E C. P. M., 30, U. S.	Left apex, scattered tubercles; pleurisy over base and in right axillary region.	Apyretic.	Hemorrhage.	0.005 to 1 c.c.	No reaction.	8½ mos.	9½ lbs.	Apparently cured; few pleuritic creaks in right axillary region; no bacilli.	
17. M. A. H. M., 18, U. S.	Right apex, small area of consolidation.	Apyretic.	Hemorrhage.	0.005 to 1 c.c.	No reaction.	1 year.	9 lbs.	Apparently cured; no bacilli.	Complications, several fistula formed in posterior wall of rectum as in Case uuu.
Advanced.									
18. E. O. R. F., 24, Canada.	Left, upper lobe consolidated; pleurisy over base. Right apex, small area of consolidation.	Fever.	Hemorrhage.	0.005 to 1 c.c.	No reaction.	11 mos.	2¼ lbs.	No bacilli for five months.	
19. H. C. F., 26, U. S.	Both apices consolidated, softening at left; ulceration in larynx; gray tubercles on epiglottis.	Apyretic.	Hemorrhage.	0.005 to 1 c.c.	No reaction.	11 mos.	2¼ lbs.	Disease arrested; small tongue-like projection on posterior laryngeal wall; no tubercles on epiglottis; aryténoids normal; bacilli present.	Had been treated with Koch's lymph before admission.
20. A. P. M., 32, France.	Left upper lobe consolidated; right apex, small area of consolidation; base, pleurisy.	Apyretic.	No hemorrhage.	0.005 to 1.3c.c.	Slight reaction first 4 weeks.	7½ mos.	5 lbs.	Disease arrested; bacilli present.	Complication, catarrhal gastro-duodenitis.
21. H. P. M., 16, U. S.	Right upper lobe, consolidated; base, pleurisy. Left apex, small area of consolidation.	Fever.	No hemorrhage.	0.005 to 0.045	Reaction steadily becoming more severe.	4 w'ks.	......	....	Gastric disturbance required washing out of stomach.
Same patient 11 months later.	Had pleurisy with effusion on right side.	... .	....	0.005 to 0.500	No reaction; temp. rarely 99° F.	4 mos.	18½ lbs.	Disease arrested; bacilli present.	Once patient raised little blood.

Far adv'nc'd.									
22. M. P. S. F., 39, U. S.	Both apices consolidated; pleurisy over left base; swollen arytenoids; ulceration of cords and posterior laryngeal wall.	Fever.	Hemorrhage.	0.002 to 0.650	Reaction at first.	1 year.	9 lbs.	Disease arrested; only dense scar tissue visible in larynx; no swelling of arytenoids; bacilli present.	Improvement in rational symptoms specially noted
23. T. G. M., 25, English.	Cavities in left lung; pleuritic thickening over base; right apex consolidated.	Fever.	Nearly fatal hem case pronounced hopeless.	0.005 to 1.8c.c.	Reaction during first 3 weeks.	1 year and 4 mos.	10 lbs.	Disease arrested; bacilli present.	
24. M. A. C. F., 22, U. S.	Both apices consolidated; left base, pleurisy; ulceration, thickening, and œdema of epiglottis, larynx, and cords.	Fever.	No hemorrhage.	0.005 to 0.015	Reaction steadily increasing.	6 w'ks.	Lost.	Unimproved.	Effect of lymph increased the throat symptoms.
25. A. T. F., 17, Nova Scotia	Both apices consolidated; œdema and thickening of epiglottis; ulceration of larynx and cords.	Marked fever.	No hemorrhage	0.001 to 0.010	Reaction on system; temp. did not average any higher.	8 w'ks.	Lost.	Unimproved.	Throat symptoms increased.
26. A. N. M., 21, Sweden.	Right apex consolidated; small area in left; œdema and thickening of epiglottis; ulceration of cords and larynx.	Fever.	No hemorrhage.	0.002 to 0.125	Reaction; temp. range higher without than with lymph.	5½ mos.	Lost.	Unimproved.	Throat symptoms less severe under treatment.

Trudeau's Modification.

Name and No. of case.	Condition at beginning of treatment.	Feverish or apyretic cases.	Hemorrhages anteced'nt to treatment.	Dose.	Reaction.	Length of treatment.	Weight.	Condition on discharge.	Remarks.
Incipient.									
27. L. T. F., 24, German.	Right apex, small area of consolidation ; base, pleurisy.	Apyretic.	No hemorrhage.	0.002 to 0.800	Reaction very marked during first 4 weeks of treatment ; temp. rarely over 99½°.	4 mos.	11¼ lbs.	Disease quiescent ; no tubercle bacilli.	First dose of 0.002 brought out unmistakable evidences of disease in left lung posteriorly ; circulation always very poor.
28. E. S. M., 20, U. S.	Right apex, small consolidation ; occasional râles behind at left apex.	Apyretic.	Hemorrhage.	0.005 to 1 c.c.	No reaction.	4 mos.	6½ lbs.	Disease quiescent ; no bacilli.	Slight hemorrhage at present time.
29. A. C. F., 18, Scotland.	Right apex, consolidation; base, pleurisy.	Apyretic.	No hemorrhage.	0.0025 to 0.015	Slight febrile reaction for first few inoculations	18 days.	Lost.	Unimproved.	From violent exercise and tight lacing patient had hemorrhage ; then developed tubercular pneumonia.
Advanced.									
30. E. C. F., 35, U. S.	Both apices consolidated ; pleurisy over left base.	Apyretic.	Hemorrhage.	0.005 to 1.3c.c.	No reaction.	8 mos.	10¼ lbs.	Disease arrested ; no bacilli for eight months.	
31. C. A. M., 21, Canada.	Both apices consolidated.	Apyretic.	No hemorrhage.	0.005 to 0.800	No reaction.	4½ mos.	9 lbs.	Disease quiescent ; expectoration almost ceased ; bacilli present.	Four and a half months ago had compound comminuted fracture of tibia, simple of fibula. Delayed union and necrosis. Just beginning to walk again.
32. J. W. F., 32, U. S.	Consolidation of both apices ; pleurisy over both bases ; some œdema of larynx.	Fever.	Hemorrhage.	0.005 to 1.8c.c.	No reaction.	10 mos.	2 lbs.	Disease arrested ; larynx normal ; bacilli present.	Lymph omitted for two months. Patient felt badly without and physical examination revealed coarse râles and sibilants at both apices. At time of writing these have disappeared after eight weeks' treatment.

33. J. S. F., 22, U. S.	Consolidated apices; extensive pleurisy at right base.	Apyretic.	Hemorrhage.	0.0025 to 1 c.c.	No reaction.	4½ mos.	Lost.	Unimproved.	Disease became active without any apparent cause, and patient's condition three months after stopping treatment is hopeless.
Far adv'nc'd.									
34. M. A. W. F., 24, U. S.	Left apex, cavity; base, pleurisy; right upper lobe, consolidated; arytenoids swollen; ulceration.	High fever.	Hemorrhage	0.002 to 0.060	Reaction slight; temp. rarely goes as high as 100° F.	4 mos.	4 lbs.	Drier condition of cavity, and fewer physical signs in lungs; no advance in throat lesion.	Complications, pleurisy with small effusion; ill for three weeks.
35. E. S. F., 24, U. S.	Left apex, cavity; pleurisy over base; right apex, consolidation; little pleurisy over base.	High fever.	Hemorrhage.	0.001 to 0 015	Reaction slight; temp. ranges lower.	6 w'ks.	6 lbs.	Little change in physical signs; cough and expectoration much less.	
36. E. Z. M., 33, U. S.	Left apex, cavity; pleurisy over base; right apex, consolidated; ulceration of cords and larynx.	Apyretic.	Hemorrhage.	0.001 to 0.020	Moderate reaction at first.	3½ mos.	5 lbs. lost.	Condition of lungs unchanged; right lung appears to remain stationary.	Disease does not seem to have progressed so rapidly as it was doing previous to use of lymph.
37. M. D. F., 24, U. S.	Consolidation of both apices with pleurisy over both bases.	Fever.	No hemorrhage	0.001 to 0.075	Reaction considerable	3 mos.	Lost.	Disease progressed steadily	
38. A. R. M., 30, Denmark.	Case of tuberculosis of kidney of full 14 months standing; wore rubber urinal night and day,	Apyretic.	Severe hem. from bladder; bacilli in urine.	0.002 to 1.8c c.	No reaction.	10 mos.	......	Irritability of bladder much less; can retain urine two to three hours. Small amount of blood still present, as also bacilli. General condition improved. During past two weeks has suffered from probable tubercular epididymitis.	

Four far advanced were given the inoculations as a last resort, one (Case 37), for three months intermittently without improvement, is now dead. In another (Case 36) only small doses of ten to twenty milligrammes are tolerated, and the progress of the disease does not appear to be so rapid as it was during several months preceding the treatment. Two very marked febrile cases (34 and 35) have gained in weight, and their temperatures average fully two degrees lower than for weeks before treatment was begun. At the same time the physical examination reveals an improved condition of their lungs, and rational symptoms are much improved.

One (Case 38) of tuberculosis of the kidneys has gained in weight, can retain his urine from two to three hours, on admission wore a rubber urinal night and day, urine contains now but a small quantity of pus and blood in comparison to what it did on admission, and his general condition is much stronger. It is a case worthy of a separate report.

Administration of lymph. It has always been the aim to administer the lymph so as not to produce any reaction, recognizing the fact that any marked systemic disturbance could only be productive of injury; and experience gained by its use in the more advanced cases has shown this to be too true. Beginning with small doses, sometimes given twice a day, until tolerance has been established (even though this may be a matter of several weeks), it has been found that patients with very advanced lesions bear the lymph remarkably well.

The method of administration was as follows: With modifications of the lymph an initial dose of 0.001 to 0.005 was given, and repeated daily unless the patient reacted, as evidenced by a rise of temperature of over 100° F. in apyretic cases, or above the average daily elevation of temperature in febrile ones, or by marked systemic disturbances. In any of these events the injections were omitted for a day or two. The dose was slowly and cautiously increased by from 0.002 to 0.005 at a time until 0.025 to 0.050 were administered. When these doses had been administered without any reaction for a couple of weeks, a partial or complete tolerance was established and the injections

were tolerated in more rapidly increasing doses. The largest dose ever administered daily without reaction was 1.8 c.c. A personal idiosyncrasy in some cases was noted, which was not apparently due to the amount of the lesion, since one of the cases was a truly incipient one and reacted very severely to doses of 0.005. Now that tolerance has been established she does not react at all to 0.008 milligrammes.

In some patients injections of 0.001, 0.002 to 0.005 twice a day were well borne, when it was impossible to give the same amount in one daily dose. This was a means of securing tolerance in a little shorter time, and at the same time it was apparently of more benefit to the patients. When the lymph has been omitted for some time subsequent treatments disclose the fact that the patient's system is much more tolerant of the lymph, and the doses can be more rapidly increased in many without any rise of temperature or other signs of reaction at all.

Reaction. The reaction to the modifications resemble in kind but not in degree those seen in the use of tuberculinum purum. Since, in some cases where the injections were given as a last resort, the reactions were moderately severe, it is possible to state positively just what effect these modifications may have.

Temperature. The temperature is at once affected by an overdose, and sometimes on the following day an afternoon rise is noted without repeating the injection; it is distinctly tubercular in character, and lasts but a few hours. There is not associated with it that marked prostration following Koch's pure tuberculin, partly because experience has warned us against using a dose of sufficient strength to produce this baneful result; and unquestionably it is due also to the fact that the greater part of these injurious products have been removed, as illustrated by some pyretic cases in which the temperature curve shows a decided downward tendency and the fever is higher when the lymph is omitted than when it is administered; further, many cases at the commencement have had no elevation higher than 99.5° F. and two have never been above 99° F.

Pulse. Upon the heart it acts as a depressant and nervous irritant; a slightly increased pulse rate with at times palpation has been noted. This was very marked in an incipient case with considerable cyanosis, although there was very little effect on the temperature.

Frequently some patients complain of vague nervous symptoms, and in some few insomnia and severe headache have been observed. In its effect on the nervous system one must consider the personal equation, since most of the patients manifesting them were women, and during the earlier stages of the treatment there was, to a greater or less degree, a psychical element entering into the production of these symptoms.

In general, its effect upon the system when not given in an overdose is just such as one meets in the anamnesis of tuberculosis in its earliest stage—general malaise, lassitude, muscular weakness with depression, slight fever (chills have been rarely seen).

That these modifications have a specific action on tubercular tissue is proven by ocular demonstration made on tubercular areas in the throat, where increased swelling and congestion were noted after beginning the injections; by the production of positive physical signs in portions of the lungs when there was previously only the suspicious evidences of disease; lastly, by the bringing out of crepitation in a patient's lungs who was being treated for tuberculosis of the kidney, and whose lungs showed no evidences of disease. In another patient with advanced laryngeal trouble she complained of severe pain and dysphagia after the first injection.

Its action on the tubercle bacilli is a matter of question, as with crude tuberculin they do not appear to take the stain so deeply and have a granular appearance. The latter condition is found in cases who do well without the lymph simply from climatic influences. Their disappearance from the sputum at an earlier stage than is the case where no inoculations have been given has been noted in some cases and is a matter of more importance. Its significance would remain a matter of discussion unless large numbers of cases were tabulated.

Its action on cough and expectoration is variable; on the whole, it can be said to diminish both cough and expectoration in all cases where the lymph is well tolerated; in some few this effect is very appreciable.

At times a streaked expectoration is noticed, which is probably due to the hyperæmic state of the tubercular nodules; in the four cases where a distinct hemorrhage has occurred, two were traceable to over-exertion on the part of patients with badly crippled lungs.

As regards its effect on the rational symptoms in general, it may be stated that these improve as the patients bear well or ill the administration of the lymph.

It has been the writer's wish to present as concise a statement of the patient's condition as possible and any facts that may be of interest. As a result of the perusal of this paper it seems:

That with the modifying of the lymph and its present method of administration the dangers of this form of specific treatment are very much reduced; that we are warranted in continuing the use of modified tuberculin in the careful manner above described; that these can be used in this way without any great risk to the patient's welfare, because it can be discontinued before any serious damage is done, and since, in one or two cases, where at first it was badly tolerated, it was subsequently administered with benefit; that far advanced and febrile cases can receive the lymph, some of them having been benefited by its use when climate and out-of-door treatment had not been sufficient to check the progress of the disease; that those in whom the lesions of the throat are most active are not at all benefited by its use—in other words, they are unsuitable cases; that at present this treatment should not be separated from the general plan of climatic and hygienic treatment.

There is so much obscurity surrounding this recent discovery that one cannot state with positiveness what its future will be. At present, the following conclusions may be drawn from a two years' observation of its use in its several forms:

1. There is undoubtedly a specific action on tubercular tissues

in each and all of them, which has in some cases a beneficial effect upon the disease, but is not, however, always permanent.

2. The modifications of Hunter and Trudeau exhibit this same action and at the same time contain much less of the injurious products than the original tuberculin, as evidenced by the comparative absence of complications occurring during their use.

3. Apparently the results attained by their use are more permanent and lasting than in other cases, the tendency to relapse in those who have done well with this treatment being less marked than in those who have improved equally without it—witness the case complicated with compound fracture of the tibia—and of all who gave any promise of being benefited only one has done badly. This would be my reply to the question which, without doubt, is occurring to the minds of all of you: Cannot the same results be secured by climate without the use of the lymph? Whether this conclusion is correct or not the future alone will disclose.

DISCUSSION.

Dr. Loomis: I have continually used Koch's tuberculin since its first introduction in selected cases. I can fully indorse the statements made in the paper, especially the conclusions—that those who improve under the use of the tuberculin are not so liable to relapse as those who improve under ordinary hygienic treatment.

The three to whom the tuberculin was first administered in Bellevue Hospital by me not only markedly improved in all their symptoms during its use while they were inmates of the hospital, but they are still alive, and, although they have evidence of disease in their lungs, are comparatively well. The case referred to by Dr. Hance, which went to the sanitarium from the hospital, is the one who presented the least hope of recovery of any of the three. Her disease is still in a quiescent state.

I am fully convinced, and have been since I first used tuberculin, that we shall reach a point where this remedy will be used with satisfaction and benefit; and the way in which this is to be reached is the one presented to us to-day, by the careful record of cases. Our personal impressions are not enough. While we may be convinced from

our own observations in a general way that these patients do well and better with it, still we require just such statistics to reach definite conclusions. Both of these papers are more satisfactory than any which we have thus far received.

Dr. Jacobi: I have no new experience since I published my reports two years ago.

Dr. Quimby: I wish to ask, as I think, for the first time in my professional relations, the privilege of a personal statement.

Having seen, as early as any one from this country, not at the time in Berlin, the applications of tuberculin as made in the German hospitals, my self-respect as a physician claiming a reasonable knowledge of pathology and a scientific training will not permit me to hear any one lay claim to an earlier recognition of the errors in its use or to priority in formulating the principles of its relations as a therapeutic agent to pathological conditions and processes, without protest. Within forty-eight hours of our first visit to the Berlin hospitals it was the unanimous expression of my associates from the University and myself that the amounts given were excessive and injurious. I am sure that Professor Loomis will bear witness that when the lymph was first given in Bellevue it was in very small doses. Going to Berlin without a word of introduction, knowing absolutely no one, after making formal application for a supply of tuberculin when excitement ran the highest, I received, in forty-eight hours after posting my application, a personal reply from Dr. Libbutz, with the promise of "lymph as soon as possible." Just two weeks from my arrival in New York I received the tuberculin, one of the first six bottles sent direct from Libbutz's Laboratory, without restrictions as to its use. A bottle stands on my shelf to-day, which I am using as from the first, in accordance with the principles defined in a paper from my pen which may be found in the *Medical Record* for January 17, 1891. I would like to ask Dr. Von Ruck the date of his first paper upon this subject.

Dr. Von Ruck: It was in the first week of January.

Dr. Quimby: Then I grant priority to Dr. Von Ruck, but I do claim the credit of an early appreciation of its action, because I should be ashamed, under the circumstances, to have failed to do so. In the paper of January 17th it is clearly stated that the physical signs, as indices of the action of tuberculin, are to be our guides in each case in its use.

[I take the liberty in revision of quoting literally from that article.]

"Anyone who has seen, as anyone may have seen in Berlin, a graded set of inoculations attended by the usual amount of febrile reaction, carry, in one patient during the space of two weeks, a condition of slight infiltration at the left apex through extensive consolidation of the upper lobe into a large cavity, with evidences of rapid softening in the adjacent tissues; while a similar set of injections

followed by essentially the same febrile reaction were productive, in a patient with more extensive primary tubercular disease, of only increased bronchial râles and some pleuritic exudation, can hardly object to the dogmatic statement that in pulmonary disease the physical signs, and not the temperature following an inoculation, should be our guides in determining both the amount and frequency of the injections." I am unable to comprehend the English language if this sentence does not embody the fundamental principles upon which tuberculin is being used by Dr. Von Ruck, and its modification at the Adirondack Sanitarium. In its crystallized form, that "tuberculin is a specialized caustic of tubercular tissue," it gives all the indications for its use, and affords an explanation of Dr. Hance's clinical observation, that the effect of its use is more marked after it has been discontinued for a time. I am aware that these statements are fundamental and general, not specific or specialized. They are, however, absolutely inclusive. I am ready to-day, as at the first, to defend the use of tuberculin upon this basis and oppose it upon any other.

I simply ask you to consider what there is remaining from the cyclone of literature upon this topic, giving valuable and available directions for the use of this substance that is not in direct accord with these principles. Tuberculin is to be used when increase of local inflammatory processes can give results that are desirable at the expense of the associated systemic exhaustion.

Under the circumstances, I feel at liberty, in revising the foregoing report, to recall Dr. Von Ruck's statement, made before the Association in reply to a direct question, that his first paper was published "during the first week of January, 1891," and to quote the following from a personal letter over his signature, dated July 5, 1893: "My earliest paper appeared in the *Medical Review*, St. Louis, January 30, 1891." My own presentation of the scientific basis for the use of tuberculin can be found in the *Medical Record* for January 17, 1891.

Dr. Hance: It is the desire of Dr. Trudeau and myself never to get a reaction; but even with small doses we may sometimes get slight reaction, which is not injurious and which the patient can stand.

As to any desire to give large doses, we have no wish to increase the dose to any given limit; it is a variable quantity according to the individual case. We have found in some cases where they were worse when they did not take the lymph than when they did, and were better under large than small doses.

Dr. Von Ruck: I did not wish to convey the idea that other gentlemen did not recognize the rather routine procedure and faulty selection of cases we occasionally saw in Berlin; neither do I claim any precedence in writing a paper on the subject of "Tuberculin," or lymph, as it was then called. Indeed, many writers published papers as quickly as possible, without even first treating a patient. Dr. Quimby's

paper was probably published before mine, as many others were; in his paper published January 17, 1891, in the *New York Medical Record*, he speaks of the *faulty application* of Koch's method of treatment, whereas I objected to the method itself, as originally devised by Dr. Koch. For instance, he objects in his paper to the dependence on the lymph to the exclusion of other means known to be valuable; in another place he makes, indeed, the statement that the "physical signs," and not the temperature following an inoculation, should be our guide in determining both the amount and frequency of the injections.

In still another he says that he is inclined to a course of brisk excitation of the local necrotic processes, and then to allow them to subside, while he justifies a clinical test of keeping the necrotic process continuously active.

A little further on is this statement: "The destructive part of the treatment has been followed to the letter, while absorption and repair upon which Dr. Koch lays such stress have been most confidingly left to Providence. As a result the laity and the elect are beginning to cry '*cui bono?*' It is just at this point that I desire to enter my protest."

With all this my claim has nothing to do whatever; and Koch did not recommend the omissions and neglects of which Dr. Quimby complained; on the contrary, he insisted upon their importance. According to Dr. Quimby, we should give tuberculin regardless of the febrile reactions, but watch the physical signs. In his paper he approved of the induction of necrotic processes, but thinks best to let them subside after a brisk excitation, and in connection with the destructive part of the treatment he protests against the neglect of proper attention to absorption and repair.

He thus recognizes the induction of necrosis of tubercular tissue as well as the doses which produce fever, and proposes to ignore the latter and to pay attention to the physical signs only, as the guide for the amount and frequency of the injections. All this criticism, based upon theory, is now entirely irrelevant. No one to-day would give tuberculin or increase the doses with disregard to the effect upon the temperature; neither is there anyone who would justify the wilful induction of tissue necrosis by tuberculin. I, on the other hand, objected and warned against Koch's original method of administration, and particularly against his recommended use of the lymph in doses which produce general reaction with fever, as not only not useful, but as poisonous, dangerous, and harmful. I objected and warned against the use of lymph with a view of breaking down tubercular tissue to be followed by absorption and repair, and recommended its use only as a stimulant to the tubercular and adjacent tissue as a means of improving the local nutrition, and with it to favor connective-tissue

proliferation and fibroid changes, not upon theory, but upon conclusions derived from practical experience in the application of the remedy, which have since been recognized by Koch and many others who still use the remedy. My publications were made in the *New Orleans Medical and Surgical Journal*, the *Medical Review*, of St. Louis; the *Times and Register*, of Philadelphia; the *Therapeutic Gazette*, the *Journal of the American Medical Association*, and the *Medical Record*, of New York; and appeared in the months of January, February, and subsequently; but owing to destruction of my files by fire I cannot give the exact dates.

As to the question of doses of tuberculin, my paper is explicit; it is, however, important to bear in mind that there is no need to reach certain large doses, and I believe that many patients have lost what they had previously gained, and often much more, by an endeavor to reach a certain dose. So long as a patient responds to minute doses he does not need larger ones, and when a condition in all respects satisfactory has been reached the remedy must be stopped, regardless of the size of the dose which has been reached.

I have not found that we can place much dependence upon any modification thus far proposed; from my experience with them, I feel justified in preferring the original tuberculin, believing that it accomplishes everything, and in some respects more, than has thus far been shown from any of its substitutes. If the case is one of uncomplicated tuberculosis, and if the general management is correct at the same time, tuberculin applied as indicated in my paper will accomplish a cure.

It must, however, be borne in mind that tuberculin is to be used for tuberculosis pure and simple, and not for the removal of septic and other complications over which it has no control whatever.

MEASUREMENTS OF THE CHEST AND LUNG CAPACITY.

By EDWARD O. OTIS, M.D.,
BOSTON.

I PRESENT these measurements of the chest and lung capacity as representing with a fair degree of accuracy the dimensions of the chest of an average man. I trust they will serve as reliable data in chest examinations. A comparison of my averages is given along with those of other examiners, and, as you see, they differ but slightly from one another. I know of no other published averages of the antero-posterior and lateral diameters of the chest with which to compare mine. The difference in these diameters in ordinary and deep inspiration is an important factor, it seems to me, in estimating the freedom and fulness of respiration.

My experience also convinces me that the measure of the so-called "complemental air," the result of the difference between the "lung capacity" and the amount of air exhaled after an ordinary quiet inspiration, is an important one in the study of the respiration of any individual, whether with or without diseased lungs. It is a significant fact that the amount of complemental air diminishes after practice in deep breathing, and this by the increase of both the factors involved in obtaining it, but more by the increase of the second factor, viz., the amount of air exhaled after an ordinary quiet inspiration. I am deeply convinced of the importance of measuring accurately in this way, with spirometer, calipers, and tape, the character of the respiration, as to the expansion and movement of the chest, as well as its freedom and fulness. This datum, added to that obtained from auscultation and percussion, gives us a pretty complete knowledge of the condition of the respiration and chest expansion.

Such an examination as I suggest is equally valuable as a prophylactic measure. I am constantly impressed with this as well as the satisfactory results obtained from deep breathing and lung-expanding exercises.

TABLE I.

Chest Measurements.

Girth of Chest. Muscular.	Repose. Inches.	Inflated. Inches.	Difference. Inches.
Men.			
Average of Dr. E. O. Otis. One thousand measurements, between sixteen and forty years of age	34.0	36.1	2.1
Average of Dr. Hitchcock, of Amherst College. Eight thousand measurements	34.6	36.5	1.9
Average of E. Hitchcock, Jr., of Cornell College. Fifteen thousand measurements	34.5	36.3	1.8
Women.			
Mt. Holyoke and Wellesley students. Measurements of Miss Wood and Dr. Mary Colton	29.5	31.5	2.0
Respiratory Chest.			
Men.			
Average of Dr. E. O. Otis. One thousand measurements	31.1	33.1	2.0
Women.			
Fifty per cent. of fifteen hundred Wellesley students. Miss Wood . . .	24.6	27.2	2.6
Depth of Chest.			
Men.			
Average of Dr. E. O. Otis. One thousand measurements in repose, and one hundred and twelve measurements inflated	7.3	8.2	0.9
Women.			
Fifty per cent. of fifteen hundred students at Wellesley. Miss Wood . . .	6.9		
Breadth of Chest.			
Men.			
Average of Dr. E. O. Otis. One hundred and fifty measurements . . .	9.6	10.8	1.2

TABLE II.

Capacity of Lungs.

Men.

	Cubic Inches.
Average of Dr. E. O. Otis. One thousand measurements	240.6
Dr. Hitchcock. Eight thousand measurements	230.0
E. Hitchcock, Jr. Fifteen thousand measurements	236.6

Women.

	Cubic Inches.
Mt. Holyoke and Wellesley students. Measurements of Miss Wood and Dr. Mary Colton	145.8
Fifty per cent. of fifteen hundred Wellesley students. Miss Wood	150.3

TABLE III.

Comparison of the "Vital" or Lung Capacity and the Amount of Air Expelled after an Ordinary Quiet Inspiration. Average of Dr. E. O. Otis. One hundred and fifty measurements.

	Cubic Inches.
Vital capacity, or the amount of air exhaled after a full inspiration	230.5
Amount of air exhaled after an ordinary quiet respiration	129.3
Difference, or "complemental" or "reserve" air	101.2
Difference as given by Hermann	97.6

DISCUSSION.

Dr. Gihon: I rise to call attention especially to the extreme importance of these diametric measurements of the chest, which Dr. Otis has presented, and which he is probably the first to make with such care and accuracy. A personal experience of physical measurement of even six thousand adolescents, all boys and young men, satisfies me that there is not much reliance to be placed in circumferential measurements alone, as ordinarily made. Some examiners make their measurements accurately horizontally—some above, some over, and some below the nipples, some at a greater or less angle, passing the tape over or below the point of the scapula. I have seldom seen the several members of examining boards arrive at *precisely* the same result, if the same individual were measured by them separately. In girls the difficulty in getting circumferential measurements of any value is manifest, except in those who have no mammary development,

which is unfortunately not uncommon. The diagrams presented by Dr. Otis, showing the outlines of various female chests, and which are apparently those of undeveloped children, have been actually taken, I am assured, from young women studying to become teachers, and are evidences of the lamentable shapes—or rather misshapes—of the American female as she is now growing.

The vital capacity is, of course, the most important of the chest measurements, and to those who have had much experience in physical examinations it is a matter of serious concern that so many of our young persons are deficient in normal vital capacity—particularly girls. I have never yet found a girl with a vital capacity that was normal, except among those who have had gymnastic exercise and who have discarded vicious and deforming styles of dress.

Dr. Levick: I have been extremely interested in the contribution of Dr. Otis. It must have required an immense amount of work to prepare such tables.

MINUTES

OF THE

ELEVENTH ANNUAL MEETING

OF THE

AMERICAN CLIMATOLOGICAL ASSOCIATION,

Held at Washington, D. C.,

MAY 29, 30, 31, AND JUNE 1, 1894.

MINUTES—1894.

THE Eleventh Annual Meeting of the American Climatological Association was held in Wormley's Parlors, Washington, D. C., May 29, 30, 31, and June 1, 1894. The President, Dr. A. H. Smith of New York, in the chair.

The Business Session of the Eleventh Annual Meeting of the American Climatological Association was held at Wormley's Hotel, Washington, D. C., May 31, 1894.

The President, Dr. Andrew H. Smith, who had presided at the previous sessions of this meeting, being called away, Dr. Isaac Hull Platt, Vice-President occupied the chair.

The minutes of the last meeting were read and approved.

The Treasurer's report was read and submitted to Drs. Otis and Hinsdale to audit, who reported it correct.

The Council recommended the following gentlemen, who were unanimously elected to membership.

Prof. Mark W. Harrington, Chief of the Weather Bureau, Washington, D. C.

Dr. Thomas D. Coleman, Augusta, Ga.

Dr. Frederick A. Chapin, Hot Springs, Va.

Dr. C. F. McGahan, Aiken, S. C.

The Council also recommended that, in order to expedite the editing of our volume of *Transactions*, authors of papers read at our meetings be required to hand to the Secretary a copy of their papers within two weeks after the meeting of the Association, for publication in the volume; and that the authors be given the privilege of the journalistic publication of the same. Carried.

The Committee on Health Resorts was made to consist of Drs. Bowditch, Otis and Von Ruck.

On motion of Dr. Frederick I. Knight the following resolution was adopted:

Whereas, The American Climatological Association was founded, among other objects, to promote the study of the nature and treatment of diseases of the respiratory organs; and,

Whereas, Tuberculosis is the most fatal cause of such diseases; and,

Whereas, Modern research has placed this among the communicable and, hence, to some extent, at least, among the preventible diseases;

Resolved, That this Association do strongly recommend the medical profession of this country to promote measures tending to its prevention.

The following officers were elected for 1895:

President.—Dr. S. E. Solly, Colorado Springs.

Vice-Presidents.—Dr. John H. Musser, Philadelphia, and Dr. G. R. Butler, Brooklyn.

Secretary and Treasurer.—Dr. J. B. Walker, Phila.

Member of Council.—Dr. Isaac Hull Platt, Lakewood.

On motion it was decided to hold our next meeting at Hot Springs, Va., at such time as may be arranged with Dr. Chapin.

The various papers hereafter appearing, with the discussions thereon, occupied the remaining sessions of this meeting.

J. B. WALKER,
Secretary.

INTRODUCTORY REMARKS OF THE PRESIDENT.

Gentlemen of the Climatological Association: Not being a resident of Washington, I cannot take it upon myself to welcome you to the capital of the Nation; but I do most heartily congratulate you upon being here to take part in the Eleventh Session of the Climatological Association and also to take part in the Third Triennial Session of the Congress of American Physicians and Surgeons. I think our session promises to be a very important one. We have a long list of papers, and the names of the writers are a guarantee that the papers will be of interest and sustain the reputation which the Climatological Association has already established. Our part in the meeting of the Congress will be also an important one. The subject is one which is of very widespread interest. In every large town and city of the country the question of sewer gas is one of pre-eminent importance. The papers are by experts in their several lines, and the discussions promise to be of a very high order. The Climatological Association is certainly going forward with all the *eclat* that we should expect of a body of men so widely known and so widely distributed. The work done in the past has been excellent and the work done at this session will be equally meritorious.

There is always something of sadness connected with these meetings from year to year; and I have to report the death of three of our members since the last session of the Association.

Dr. James J. Levick, of Philadelphia, who took an active interest in the meetings of the Association and was especially active at the last meeting which was held at Philadelphia, died after a very short illness.

Dr. H. M. Wilson, Jr., of Colorado, whence he had gone on account of his health, returned to die at his home in Baltimore.

Dr. A. C Storndart, of Salt Lake City, joined the Association at its Denver meeting.

PAPERS

READ AT THE

ELEVENTH ANNUAL MEETING

OF THE

AMERICAN CLIMATOLOGICAL ASSOCIATION.

HELD IN

WORMLEY'S HOTEL,

Washington, D. C.,

MAY 29, 30, 31, AND JUNE 1, 1894.

ADDRESS OF THE PRESIDENT.

LIMENTATION IN PULMONARY DISEASES.

By ANDREW H. SMITH, M.D.,
NEW YORK.

Alimentation plays a most important part in the management of disease in general, but in pulmonary affections the problem is complicated by special conditions growing out of the function of the affected organ.

We are apt to regard nutrition too much as if it were only another term for digestion, and practically to assume that if the food taken into the stomach goes through the proper changes in the alimentary canal, and the nutritive portion is properly taken into the blood, that is all with which we need have any concern. But the truth is that all may go on perfectly well up to this point, and most serious defects in the nutritive process still be in store for the patient.

The products of digestion when received into the circulation are not blood. They represent neither serum nor corpuscles; they are, in fact, dead matter, requiring to be vitalized by the process of assimilation before they become a part of the living blood. Of the manner in which this change takes place we know almost nothing. We even do not know in what organ or organs the corpuscles are formed, but we do know that an essential factor is the process of oxygenation that takes place in the lungs. This fact, which is amply attested by physiological observations, may be readily illustrated by anyone in his own person. We all know how a few moments in the open air will increase the appetite for the morning meal, although

the condition of the stomach is the same as it would have been if we had remained in the close atmosphere of the sleeping-room. In both cases the stomach is empty, but in one case the fresh air has thoroughly oxygenated the nutritive material in the blood derived from the meal of the previous evening, and in the other case a part of that material is circulating still in an unassimilated condition, and dulling the appetite as effectually as if it had remained in the stomach. For the desire for food is less an expression of an empty stomach than of the absence of unassimilated material from the blood. It is not the completion of digestion so much as the completion of assimilation that is the signal for more food.

It is the fact that the lungs are the seat of this essential part of the assimilative process that gives to pulmonary affections a peculiar relation to alimentation. For any considerable impairment of the action of the lungs cannot fail to impair at the same time the normal rate at which the crude products of digestion are converted into living, active, life-sustaining blood. Material which has not undergone this change is, for the time being, not only useless to the economy, but a hindrance to proper metabolism. We see this illustrated in the hebetude and languor resulting from an insufficient supply of fresh air during digestion, and the prompt disappearance of these symptoms when the blood is fully aërated.

If, then, a considerable obstruction exists to the entrance of air into the lungs, it follows that an addition of more nutritive material to the blood than can be duly acted upon under the circumstances of crippled respiration will only add to the circulatory embarrassment and aggravate the condition of the patient.

Under these conditions, therefore, we should study in acute cases to give as little nourishment as will sustain the vital powers, rather than as much as the stomach can be made to digest. It is here that I believe a serious error is being constantly committed. In pneumonia, for example, the reaction from the excessive spoliation formerly in vogue, coinciding with an acute appreciation of the great nervous and muscular

depression present in some cases, has led to an unreasoning effort to combat the disease by forcing food into the stomach. It is not long since the average hospital interne seemed to consider that his faithfulness to duty in a case of pneumonia was measured by the number of ounces of milk and beef-tea the unhappy patient could be made to swallow. To-day this idea is less prevalent, but it still has not entirely lost its force. We need constantly to remember that the extreme prostration so often seen in pneumonia is the result of a toxic infection of nerve and muscle, and that this toxemia can no more be combated successfully by excessive feeding than if it were caused by the poison of a cobra or a rattlesnake. Efforts to "keep up the strength" by this means will result only in imposing a fresh burden upon the eliminating organs in getting rid of unassimilated material.

If we turn from this type of pneumonia to that in which the peril lies in the excessive strain upon the right heart, due to impediment in the pulmonary circulation, we shall find that here, too, only harm can result from crowding the vessels with more pabulum than can be acted upon in the gorged and paretic pulmonary circulation. The venous blood is dammed back in the lungs, and the right heart is forced to keep up a twofold struggle between the obstruction in front and the pressure from behind. It is in an evil case at best, but its plight may be made worse by adding to the mass it is required to move a quantity of material which cannot be made available for any useful purpose so long as the oxygenating function of the lungs remains in its crippled condition.

But not less important than the quantity is the nature of the food. As the ultimate destiny of nutriment is to become tissue, that should be selected which requires least change to convert it into tissue. All forms of food are derived originally from the vegetable kingdom, but a large share of the work of converting vegetable material into our tissues may be done for us by the lower animals. It is well to avail ourselves of this assistance when for any reason the conversion within our own economy is deficient or delayed. Flesh food is usually more readily digested than the

carbohydrates, and the resulting peptones when taken into the blood are much more nearly allied to the tissues than are the sugar and other products that result from the digestion of vegetable substances. We shall, therefore, favor the chances of complete hæmatosis if we select nitrogenous food. For the sake of greater ease of digestion, it is better to give the nourishment in liquid form, and if given in small quantities, at short intervals, we shall avoid undue repletion both of the stomach and the vessels. When the patient is fully conscious his sensations can be trusted as a guide to the amount of nutriment required, and food should never be forced upon him when his instinct rebels against it. Plain water, however, should be freely offered, and will often be gratefully accepted when liquid *food* would be refused, the instinctive feeling of the patient discriminating at once between what will keep the blood fluid and facilitate its circulation and what would act as a burden and a clog.

If now we pass to chronic affections of the lungs, the same principle will hold good with certain important modifications in practice. We have here a chronic condition in which we are confronted with a restricted hæmatosis on the one hand and urgent necessity for a high degree of nutrition on the other. The difficulty of reconciling these two conditions will be in proportion to the degree of lung insufficiency. How familiar is the picture of the flattened and motionless chest of advanced fibroid phthisis, with the accompanying complete anorexia, and the consequent bloodless face and white conjunctivæ. There is no appetite; not because of any faulty condition of the digestive organs, but because nutritive material taken into the blood continues to circulate in its crude and unassimilated form for lack of proper oxygenation, and its presence in this form excites a constant protest against a further ingestion of food.

In the minor degrees of chronic lung insufficiency the respiratory movements make up in frequency what they lack in amplitude. So long as this compensation can be fully maintained there may be no considerable defect in hæmatosis, and, in the absence of fever, no marked failure of nutrition. But

sooner or later a time comes when the respiration is so far impaired that enough oxygen cannot be taken into the blood to act upon such an amount of nutritive material as is necessary for the full maintenance of the economy. The moment this stage is reached, the appetite fails in proportion to the defect of hæmatosis. This is in accordance with the conservatism of Nature, and we should heed the warning. Unless we can improve the hæmatosis, and with it the whole process of metabolism, we shall only do harm by high feeding. Digestion in these cases fails as well as assimilation, for the digestive fluids will be inefficient in proportion as the blood is poor from imperfect hæmatosis. What can we expect from the peptic glands when they are supplied with a blood containing no more than half the usual number of corpuscles and only 20 or 30 per cent. of hæmoglobin? Moreover, in these chronic cases with pronounced anemia and emaciation, we cannot rely chiefly upon nitrogenous food, as we must do in acute affections of the lungs. The heat-producing hydrates and fats are required in addition, and these are more difficult of assimilation. Hence, a vicious circle is established, the defective hæmatosis aggravating the dyspepsia, and this in turn resulting in greater poverty of the blood.

Under these conditions life in the open air is of the utmost importance. Every atom of oxygen taken into the blood means a corresponding amount of assimilated pabulum for the tissues and better blood out of which to elaborate the digestive ferments.

I have obtained much benefit in cases of this kind from rectal injections of defibrinated blood. This material seems to be absorbed almost unchanged, the corpuscles as well as the serum, it being a frequent experience that no trace of blood is found in the next dejection. There being no digestive action upon the blood, its absorption into the venous circulation is almost equivalent to transfusion very slowly performed; and but little change in the way of hæmatosis is required to fit the added material for the immediate use of the tissues.

This practice frequently results in a prompt improvement of

the digestion, the gastric and intestinal glands being furnished with a richer blood, and yielding, consequently, a more efficient product.

The benefit is sometimes very striking. I recall a case treated at the Presbyterian Hospital some years ago in which the patient was so far gone with phthisis that I was surprised each day when I came into the ward and found his bed still occupied. There was an enormous cavity at the summit of the right lung ; the patient was emaciated to the last degree, weighing only 101 pounds the last time he had been able to stand on his feet to be weighed. He was extremely anæmic and took almost no food. He had been in the hospital since August 18th, and had gone down steadily in spite of all the usual restorative treatment. On November 5th the treatment with blood enemata was begun, four ounces being given each night at bedtime. After a few days the dose was reduced to two ounces. In two weeks he gained seven pounds. His appetite returned, and his digestion improved. He gained strength rapidly, and at the end of three months left the hospital at his own request, having gained thirty-three pounds, and considering himself well. The cavity in his lung had contracted greatly, and expectoration had nearly ceased.

Other cases less striking than this, but still very remarkable, were reported to the Therapeutical Society in 1879, and published with the proceedings of the Society in volume xxix. of the *New York Medical Journal.*

Though I prefer defibrinated blood for this purpose, for the reasons already given, good results may be obtained with the materials usually employed for rectal feeding, provided the patient can live much in the open air. I am convinced that rectal alimentation should enter largely into the institutional management of phthisis. In private practice it is difficult to carry it out, especially in its most effective form, that is, with defibrinated blood.

I have said nothing in regard to the use of alcohol as food. The subject is too large to be entered upon on this occasion. I will only say that I have yet to be convinced that alcohol has

not a nutritive value, if not directly, at least as aiding in the assimilation of other material. Clinically its usefulness seems to me more than as a simple stimulant. Both in acute and chronic pulmonary disease I believe that, carefully employed, it has a place that cannot be filled by any other agent. The quantity given need not be great, and if the odor of alcohol in the breath is persistent and very noticeable, it is a sign that the proper dosage is being exceeded.

The foregoing is a necessarily brief and imperfect presentation of a subject, the details of which would repay thorough consideration. From the titles of some of the papers that are to follow, I trust that we shall have the benefit of other views and additional experience.

THE RATIO WHICH ALIMENTATION SHOULD BEAR TO OXYGENATION IN DISEASE OF THE LUNGS.

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WITHIN the past two decades much has been heard of superalimentation and forced feeding in phthisis. It seems to have been assumed in many quarters that the more food a consumptive could be made to take the better his chances of recovery. Recent studies and observations have, however, led the writer to consider seriously whether it is not just as true in disease of the lung as it admittedly is in other diseases, that any excess of food beyond the amount which can be perfectly digested and assimilated, is injurious. It seems even probable that in pulmonary affections the gaseous products of indigestion and imperfect oxidation being partly excreted by the lungs, may be more deleterious than in other cases.

The title of this paper assumes that there exists a definite ratio between the amount of oxygen which a pulmonary patient takes in and the amount of food which he is capable of digesting and assimilating.

When the intake of oxygen is large, as occurs in the case of robust persons who are exercising actively in the open air, it is manifest that a maximum amount of food will be demanded and can be safely given.

When, on the other hand, a patient has one or even both ungs crippled by disease, leaving him as often happens, only one-half or one-third his normal breathing power, and is moreover entirely at rest, being confined to bed in a close, illy

ventilated room, his consumption of oxygen is relatively very small and the amount of food which he can digest and thoroughly oxidize into a nutritive pabulum for the uses of the economy is very much less.

Between these two extremes are found patients with all possible degrees of capacity and opportunity for absorbing oxygen, and in consequence equally varying degrees of capacity for digesting and assimilating food. If the bed-ridden patient with only one lung be compelled to ingest even one-half as much food as is imperatively required by the robust out-door laborer, mischief must result from the surplus which could not be oxidized into assimilable forms, even if it were possible for it to be digested.

Evidently, then, there is such a ratio as has been assumed, and it is exceedingly important that this fact be borne in mind in deciding as to the proper feeding of any case of lung disease.

My attention of late has been particularly directed toward the study of diet and digestion, and meeting often with such surprisingly good results from carefully selected and occasionally even severely restricted diet in numerous forms of disease, it occurred to me last winter to ascertain what a more careful diet in connection with a larger allowance of oxygen in the form of pure air could do for my consumptive patients. About the time when this resolve was made there came into my hands several new cases of phthisis pulmonalis, including one in which, on account of the extreme irritability of the stomach, full feeding was out of the question. Following will be found a report of it:

Case I.—Married man, aged thirty years, first seen by me January 19, 1894. Occupation, driver of express wagon. Was always strong until sometime in August, 1893, when he began to cough severely and to have short breath. He first noticed that he had fever about the first of October and took to his bed early in November on account of fever and debility. He had previously vomited a good deal, often as much as five times a day. Had remained in bed from the time mentioned till he came under my care. He had been vomiting while in

bed several times daily, and particularly after nearly all his meals. His previous medical attendant was said to have urged very liberal feeding; that the patient be made to take as much as he possibly could. I found him with a temperature ranging from 101° to 102° in the afternoon, and with a pulse usually much above 100.

He had weighed the last time he had been able to get out, nearly two months before, 112 pounds. I should have estimated his weight at somewhat less at the time of my first visit, probably about 105 pounds. He was then expectorating an abundance of the usual nummular sputum of phthisis in the second stage, and said he had been doing so for several weeks. He was having copious night-sweats, and his nights were further disturbed by a frequent harassing cough. Examination showed dulness on percussion at the right apex anteriorly and somewhat less marked posteriorly; increased vocal fremitus and subcrepitant râles over the same regions, with some gurgling râles and cavernous breathing at a point in front a short distance below the clavicle. At the left apex anteriorly there were the usual signs of a slight infiltration. He lay in bed heavily covered, in a close warm room of very small dimensions and without any ventilation, except such as was afforded by a door opening into a staircase which led to the living rooms below. The directions now given were that the windows in the room should be opened to the fullest extent possible, and kept so constantly during the day, except in very bad weather, and should be open at least six inches at night; patient meanwhile to be covered just sufficiently to be comfortable. To prevent his taking cold and to improve his nerve tone he was to be sponged with at first cool, and later on with cold water every morning. He was allowed small portions of the blandest liquid diet at intervals of two hours, and tablets containing one-tenth of a drop of creosote were administered, one every two hours, to stop the vomiting and improve digestion. Vomiting ceased and never recurred, except once some ten days later on account of having eaten imprudently in violation of express rules. After the stomach had regained its tone and

the appetite had become voracious, as it did without other medicine, from the effects of the spongings and freer ventilation, I was obliged to impose stringent restrictions to prevent his overeating. He was allowed a plain breakfast of beefsteak or chops and bread and butter, preceded an hour before by a glass of hot water, in which was dissolved a little table salt. In the middle of the day he was directed to take instead of his accustomed hearty dinner, merely a light lunch of crackers or stale bread and butter, with a baked apple or grapes or oranges. His supper was much the same as his breakfast, except that either roast or broiled meat or fowl was permitted, with one or two vegetables; no desserts except fresh fruits. Milk was also permitted.

Pari passu with the gain in stomach-tone there was an improvement in the cough, fever, and most of the other symptoms. By the end of two weeks the temperature had ceased to rise above 99.5° in the afternoon; the night-sweats had nearly disappeared, and there was no longer any sputum though still a dry cough. The physical signs showed corresponding improvement. The pulse continued to be weak and rather rapid, and attempts to strengthen it by administering a glycerite of the hypophosphites (Churchill's formula) disturbed his digestion somewhat, and so was abandoned. Minute doses of iodide of arsenic were then given with good effect, and at times small doses of creosote were again administered. From the beginning his chest was painted with tincture of iodine over the affected areas every day till the skin became sore; then it was left a few days until new skin formed, when the painting was resumed, and so on. He continued to improve in all ways until, by the end of the month from the time treatment began, he was able to drive out every pleasant day, and was required to sit or lie on a cot in front of his house in all weathers except the roughest. Fortunately the winters in Atlantic City are usually very open and mild, the past winter having been exceptionally so, and therefore this patient enjoyed a continual out-door air bath from morning till night almost every day. By this time his weight had increased to 126 pounds, and there was no

longer any elevation of temperature, except that it occasionally reached 99° at night.

On February 27th the patient began to suffer from a relapse which I attributed to a lapse on his part from the stringent dietetic rules which had been imposed on him. He had gone back to his former habit of eating a heavy mid-day dinner in addition to two other hearty meals. *Post hoc*, whether *propter hoc* or not, he began to cough and raise sputum, and for several days his temperature again arose above 100° in the late afternoon, while the physical signs showed moist râles below the right apex. A return to his former strict diet was followed by a prompt improvement again, which progressed thereafter uninterruptedly.

By May 2d patient had recovered his former appearance of robust health and weighed 132 pounds. He had been at work since early in April. On the date mentioned he was presented at a meeting of the Atlantic County Medical Society and examined by a number of members. At that time there was still some dulness below the right apex, with a rather harsh respiratory murmur, but no râles whatever. He reported that he had not coughed at all for three or four weeks and that he felt as well as he had ever done.

The foregoing case has seemed sufficiently important to be reported in detail on account of the very prompt and striking effects which resulted from giving the man more air and less food than he had been receiving before. The report also embodies substantially the method of treatment both hygienic and medicinal which has been followed in numerous other cases of pulmonary disease which have been under my care the past winter and spring. Reports of these are here appended.

Case II.—Widow, aged forty years, resident of Philadelphia, sojourning in Atlantic City for her health; said to have had peritonitis in March, 1893, and since then to have taken morphine, her dose when she came under my care having been about one grain daily, hypodermatically, with proportionate amount of atropine. She had been coughing more or less for upward of a year and badly for about a month, dating from an acute

attack in Philadelphia of what was considered to be congestion of the lungs threatening pneumonia. She was very thin and emaciated and exceedingly nervous. She was supposed to have had at one time spinal meningitis—probably aggravated spinal irritation. Her temperature was at the time of my first visit, December 27, 1893, 99.6° at 11 A.M., and subsequently ranged from 100° to 102° in the late afternoon. She had sweats at night until they were controlled by a pill of agaricin $\frac{1}{12}$ grain, with Dover's powder 1 grain, one or two of which were given at bedtime. She coughed hard, especially at night, raising a moderate amount of characteristic tubercular sputum, and occasionally vomited after eating, though with nothing like the frequency of Case I. Examination showed the usual signs of a small area of consolidation at the left apex, with a larger one at the right which had begun to soften. The treatment adopted was similar in the main to that described in Case I. Morphine was gradually withdrawn, codeine with nerve tonics being substituted, and later the codeine itself was withdrawn. Similar diet rules were made as in the previous case, but could not be carried out so strictly, since the patient lived in a boarding-house in which dinner was served in the middle of the day and the menu at supper afforded a scanty variety. Sweets were forbidden, and moderation enjoined as to starchy articles. The net result was that the patient took considerable less food than before, and in consequence digested it much more perfectly. She had a fairly good stomach after she began to improve, and creosote was given her in doses of from one to three drops after eating.

On January 5th there was a slight hæmoptysis which was promptly controlled. By January 20th my notes show that her temperature no longer rose above 99.5° in the afternoon, and the cough had ceased entirely, not having troubled her at all for the week previously. All narcotics now discontinued.

January 27th, there was a return of fever, the temperature rising to 101°, but without any return of the cough or expectoration. The patient had been disregarding her diet rules and indulging in some indigestible compounds. Within a few days,

she meanwhile having been kept in a recumbent position, the fever disappeared and the temperature for sometime afterward did not go above 99°. The early and apparently entire cessation of the cough was very noteworthy, but the dulness on percussion remained with some harshness of the respiratory murmur. Some slight moist sounds persisted long after the patient insisted that she no longer coughed or raised anything, but by the end of two months dulness and some increased vocal fremitus were the only noticeable signs over the affected areas. She had gained five pounds in weight and was less nervous.

The patient left Atlantic City for the interior of Pennsylvania May 1st, and during four or five days preceding that date she had complained of a slight cough for the first time in three months and had occasionally raised a little sputum in the morning. The temperature remained normal, but a few faint râles were found to have reappeared at the right apex. On May 18th a letter was received from her stating that she had developed whooping-cough of a severe type, and with this was again having fever and night-sweats, so that a serious relapse of the tubercular trouble has evidently taken place as a result, probably, of the pertussis, which possibly caused the slight return of cough in the last days of April.

Case III.—Lady, aged twenty-five years, a member of a family in which there has been much tuberculosis. Had always been accustomed to plain living, but last summer gave up housekeeping and boarded in a house where the table was rather luxurious. Her digestion became somewhat impaired, and about midsummer she began complaining of a stubborn dry cough. The usual remedies had no effect, and in December last I found slight but well-marked infiltration of both apices. Her diet was restricted, though less than in the two previous cases, since her habits were active, and the same regimen was enjoined. The cold sponge baths and constant counter-irritation by means of iodine were particularly insisted on, and the patient having been somewhat of a bicyclist in former years, was urged to resume that form of exercise and keep out of doors on her wheel as much of the time as possible. She was

directed to take continually creosote in doses of one to three drops on sugar after each meal. She shortly after began to show improvement, and with few but interruptions progressed favorably until at this writing, May 18th, she weighs six pounds more than at the time of beginning treatment, and no longer coughs. Her temperature, which was rising pretty regularly to 99.5° and sometimes to 100° in the latter part of the day, has for sometime not gone above normal. The physical signs indicate an arrest of the disease at both apices.

Case IV.—Widow, aged twenty-nine years. Husband died two years ago of phthisis complicated with alcoholic gastritis. Patient has always had good digestion and been fond of sweets, including candies and not over-digestible lunches between meals. Had a hacking cough since the time of her husband's death and been much emaciated, her weight ranging between 80 and 90 pounds. A year ago, after an attack of *la grippe*, began to expectorate. She came under my care in February last, and I then found a small consolidated portion of lung below the right apex, as plainly shown by signs recognizable both in front and behind. There were also numerous subcrepitant râles in the same region. She had been seen by Dr. R. G. Curtin, of Philadelphia, some months before, and he advised that she should take guaiacol. Her former medical attendant had continued this drug, giving no other medicine. I also directed that the guaiacol be continued in doses of two to three drops after meals, and placed her at the same time upon a somewhat restricted diet, forbidding especially all lunches between the three regular meals, except that milk was allowed at bedtime, and cutting off rigidly all indigestible dishes.

Constant counter-irritation over the affected spot was ordered, and the patient was strictly enjoined to spend a large part of every day out of doors, except in the worst weather, and to have ample ventilation of her room at night. The clinical thermometer, the regular use of which I always insist upon in all cases of suspected tuberculosis, showed slight rises of temperature for sometime after the patient came under my care, never, however, going above 100°, and within a few weeks after

the hygienic measures above described were instituted it ceased to rise above 99°. The expectoration also gradually diminished. At the time of my last examination, May 14th, there was still dulness at the right apex both in front and behind, with slightly increased vocal fremitus and wavy respiration, but no râles of any kind, and the patient reported that she had neither coughed nor expectorated for three or four weeks. Her weight had increased to 92 pounds, which is above her average for the past six years. I consider the disease arrested in this case, but the patient is continuing the guaiacol with the still more important hygienic precautions. She now eats all her appetite demands at the three meals, but takes no lunches except the milk at bedtime.

Case V.—Shopkeeper, aged sixty-two years, of very broad chest and robust build, weighing shortly before he became ill, 220 pounds. Was called to him January 18th, 1894, on account of a moderate hæmoptysis. He had been coughing somewhat for six months or more. A small dull spot was found a few inches below the right apex anteriorly, and there was feeble respiration over the same region. The bleeding yielded rather slowly to treatment and was followed by a rise in the temperature, which reached 101° at night, falling to the normal again in the morning. There began to be raised a considerable amount of sputum, which continued to be blood-streaked for a week or more. The cough became very severe, especially at night. The patient had also long suffered from intestinal indigestion with flatulence and constipation. He was ordered a plain but substantial meal, mainly of meat, eggs, or milk, morning and night, with a light lunch in the middle of the day; also a full pint of hot water an hour before each meal, with a view to overcoming his constipation and lessening his obesity. His chest was sponged with cold water every day and the skin over the affected region was kept sore with iodine. Creosote in small doses was given after each meal, and, on account of the unusually severe character of the cough, which prevented sleep and threatened further hemorrhage, an anodyne mixture had to be administered at night.

A slight recurrence of hæmoptysis at the end of a week complicated matters, but after this marked improvement set in. The temperature speedily fell to normal, cough and expectoration steadily lessened, and, what most delighted the patient, his constipation and intestinal flatulence were overcome, while his protuberant abdomen sensibly retracted. For nearly a month this improvement continued, and the patient seemed to be getting well, when he contracted a severe cold by standing on a street corner engaged in conversation while overheated by a long walk, on a cold day in March, and the congestion thus set up resulted in another hemorrhage. From this time on hemorrhages recurred every week or two in spite of a plentiful use of the best astringents. The infiltration finally involved the greater part of the right lung and invaded also the apex of the left. A cavity has formed in the centre of the right, and the case is likely now to follow the usual course. After the hemorrhages began to recur with such alarming frequency the hygienic method was virtually abandoned; efforts were made to restrain the violence of the cough at all hazards, and anodyne cough medicines had to be resorted to freely regardless of the effect on digestion. Moreover, the family had an invincible dread of fresh air, so that all attempts to carry out the plan of securing a freer oxygenation of the blood were nullified.

Case VI.—Physician, aged thirty-six years. Had infiltration below right apex when a medical student in Philadelphia, in 1879, according to the diagnosis of Prof. J. M. Da Costa. He had fever and cough during most of the following winter, and had to abandon his studies for some time. The disease was later controlled, and he regained good health. In October, 1893, having meanwhile moved to Atlantic City, he again developed cough with a return of the signs of consolidation in the right lung. His temperature was a little above normal nearly every afternoon till about the first of January, 1894, and occasionally, though rarely, reached 101°. He treated himself for the most part, but occasionally consulted me during the months of December and January. He has always had a perfect digestion and made no change in his usual full diet—

three regular meals daily, with dinner at night, except that a generous allowance of milk was now substituted in part for other less nourishing foods. He continued in full practice, and was riding out of doors in an open buggy during the greater part of every day and much of the time during the evening. Vigorous counter-irritation was kept up over the affected spot, and creosote was taken to the extent of about fifteen drops daily.

Various tonics, including cod liver oil, arsenic and strychnine, were taken at different times. In short, the treatment was counter-irritant, antiseptic and roborant to the fullest extent, and, what was doubtless most important of all, oxygenation was maintained at the maximum point possible without over-fatigue by almost continual driving out of doors in a pure air. By the middle of December the signs as well as the symptoms indicated a rapid arrest of the disease. His weight at the beginning of the attack had fallen to 158 pounds, and is now 186 pounds. Some dulness persists over the area formerly affected, but otherwise the patient is well. He has had no expectoration and no cough whatever for nearly three months.

In Case V. a specimen of the sputum obtained at an early stage of the disease during a long interval of improvement, when the cough and expectoration had almost ceased, was examined microscopically by Dr. D. Braden Kyle and a few bacilli found. No examination of the sputum was made in the other cases, since the physical signs and symptoms were decisive and left no room for doubt as to the character of the malady in them.

The foregoing do not represent selected cases, but include all the cases of undoubted phthisis that have been under my care for any considerable time during the past winter and spring. One serious case in the third stage, which was sent by Dr. Ralph Walsh, of Washington, D.C., remained about two weeks only, since, though some little improvement occurred in appetite and digestion from the change of climate, I was unable to promise any lasting gain from a longer sojourn. A number of others in the early stages, in the persons of transient visitors, were seen a few times, most of them at my office,

and, as a rule, there was more or less amelioration of the symptoms, but none of these were under methodical treatment.

The results in the six cases above described (four of the number being either well or convalescent) are on the average better considerably than I have been accustomed to see in former years, when it was not my practice to impose any restrictions in the diet of consumptives, but rather to encourage the fullest feeding possible. Neither in my experience in Atlantic City during many years previously to the past winter, nor in Thomasville, Ga., during the winter of 1892–93, where I saw a large number of cases of tuberculosis in all stages, were the fever, cough, general nutrition, and body-weight found so generally to improve under any of the methods of treatment then employed. These later results have been obtained in four out of the six cases, with the aid of so little internal medicine, and that little addressed almost entirely to the digestive tract, that the conclusion seems irresistible that the management of the diet and hygienic regimen generally should receive the chief credit. The other two cases, V. and VI. are the exceptions which prove the rule. Case V. had a rather poor digestion, and the anodyne and astringent mixtures, apparently necessitated by his cough and recurring hemorrhages, exerted without doubt an injurious influence upon his digestive organs.

Case VI. had a stomach which could digest anything, and, therefore, this patient could bear, and progress favorably under, a more active medication than most others.

It is doubtful whether any drugs yet discovered have a directly curative effect on tubercular lesions, though there may be a few, including some of the preparations of the hypophosphites, which, by stimulating the circulation of blood in the lungs, aid in improving the nutrition of the diseased tissues. It is probable that the majority of the drugs, as well as those changes of climate which seem to exert a favorable influence in pulmonary cases, effect their good results for the most part indirectly by increasing appetite, improving digestion, and stimulating the vital processes generally, thus increasing the quantity and bettering the quality of the blood that reaches

the diseased structures. Indeed, we are justified now in believing that an abundance of pure, healthy blood circulating normally in the lungs is the most essential pre-requisite to a cure of phthisis pulmonalis. Hence the paramount importance of looking closely to the blood-making processes by securing as perfect digestion as possible, together with a complete oxidation of its products, so as to spare the lungs from the injurious task of assisting in the excretion of the poisonous compounds resulting from suboxidation and decomposition. To attain these ends satisfactorily the total amount of aliment ingested must not be in excess relatively to the amount of oxygen absorbed.

We may, therefore, safely insist upon liberal feeding whenever the patient can exercise freely out of doors in any clean, aseptic air.

When, on account of fever, rest of the body is temporarily necessary, a fairly good supply of oxygen is still obtainable by causing the patient to lie on a bed or hammock out in the open air. When this is not practicable we should have the windows of his bed-room kept widely open, resorting to extra bed covering if required. In this way a much larger amount of food can be taken with safety and advantage than when the patient is kept confined in an unventilated room.

While insisting that the patient shall be kept out of doors as nearly constantly as possible, and at all events shall always, night and day, have an abundance of fresh air to breathe, whether within doors or without, it may be noticed that I have hitherto said little about the relative value of different airs or climates for cases of the disease under consideration. The reason is that I consider the importance of selecting a special climate for such cases greatly overestimated. Certain climates are doubtless somewhat more suitable than others for lung diseases, but the difference is much less than is commonly supposed. The germ-laden air of crowded cities is naturally less curative than that of the country, seashore, or mountains. The purer the air the better, and, contrary to a prevalent notion, the colder the air the better, provided only the patient can and will educate himself to be out in it and breathe it freely. It is said

that the only climate in the world where consumption does not exist is that of Iceland.

It is true that changes of climate exert a powerful stimulant action upon nutrition, for a few months especially. Hence, persons afflicted with pulmonary disease who have means to travel can often benefit greatly by changing from the seashore to the mountains, or *vice versa*, after they have ceased to improve as at first. But to send consumptive patients with slender purses to a distant resort, in the hope of finding some peculiar or magical virtues in the air of the place different from that of their own, is usually as disappointing as it is cruel. Such patients as can ill afford the luxury of travel, if still in an early and curable stage, should be urged to lead an out-door life in any locality (preferably away from large cities) where they can do so most conveniently and economically, and where the climate is not so rigorous as to prevent. If they are in a far-advanced and hopeless stage, they should be made as comfortable as possible in their own homes.

About twelve years ago a clergyman residing in Delaware came to Atlantic City with a diagnosis of phthisis made by a prominent specialist in Philadelphia, and sought my advice. It was a plain case, a large part of one lung being consolidated, but softening had not yet begun. At that time I had given little thought to the subject of diet in such affections, but poor parsons are not apt to be over-fed. I told him to give up his pulpit for a year and go out into the country, spending his time on horseback or in any way most agreeable to him, so long as he remained in the open air. He was also to keep up counter-irritation over the affected lung. He took the advice and got well, so that he was able to resume his work by the end of the year. I have never seen him since, but he often sends me a box of the best Delaware peaches, accompanied by a letter full of gratitude to me for having shown him the way which led him back to health.

DISCUSSION.

Dr. Butler: There is one point in the President's most excellent address which I think deserves a word of mention. It is a confirmation of certain ideas which I have carried out in hospital work as well as in private practice as far as practicable. That particular point refers to the alimentation usually practised in acute febrile diseases. The medical interne in my hospital service understands that all cases of acute febrile disease are to be lightly fed, certainly for the first few days of their course. Such practice is based upon this line of reasoning: An acute febrile disease is attended with suppression, or almost entire suppression, of the digestive fluids. The secretion of saliva is lessened or stopped; the flow of the gastric juice, the pancreatic juice, and other fluids of the intestinal tract is lessened or stopped. If food is given during the first few days of the fever, it is met with what is practically an absence of the power of digestion. Even if predigested food be given the power of absorption is impaired. After the febrile movement has continued for a certain number of days—varying with the severity and the character of the disease—the digestive fluids begin again to be secreted. The body, as it were, becomes accustomed to the abnormally high temperature, just as it sometimes becomes accustomed to the presence of ptomains in chronic blood poisoning. When secretion of the digestive fluids begins to be reestablished, then is the time for beginning alimentation. In private practice the great objection to very light diet is, of course, the fear of the sick person and his friends that he will be starved. Of course, we know that that is absurd. Life may be supported for many days, even in the entire absence of food, on water. If solid or fluid food is given in the early stages of the fever, it is apt to cause more or less gastric and intestinal trouble—flatulence and vomiting and nausea—from the non-digestion and poor assimilation. It is a valuable practice to feed the patient lightly, certainly for the first few days. The diet should consist of fluids which contain little or no solids, viz., waters, beef-tea, clear soups, tea, coffee, lemonade, or other fruit beverages.

Dr. Babcock: There are two points of great practical importance that we should take into consideration in the nourishment of our consumptive patients. The first has reference to lessening the great waste of nitrogenous tissue which takes place in pulmonary disease, whether acute or chronic, and when characterized by great emaciation. Hydrocarbons are recognized as being an albuminoid sparing food; that is, fats lessen or rather influence a lessened taking in of oxygen through their power of diminishing the demand for oxygen on the

part of the tissues. When in a chronic pulmonary disease, as consumption, characterized by a great wasting of pulmonary tissue, there is a lessened ability to absorb oxygen, it is essential that we supply our patient with as much fat as possible in an easily absorbable form.

We do this, but we do it empirically. In acute diseases, as acute pneumonia, it seems to me it might be well to bear this in mind, and endeavor, when we feed our patients milk, to have it as rich in cream as they can well absorb.

The second point has reference to the danger of hæmoptysis when we over-feed our consumptive patients. The pulmonary circulation is under much higher tension than the systemic, because the circuit is smaller and the blood is forced through the lungs under greater pressure. Now if we have a patient with a cavity there is always possible danger of hæmoptysis from a too rapid augmentation of the volume of the blood by a large consumption of food, whether solid or liquid. This explains, I think, why in some cases, when our patients appear to be doing remarkably well, they suddenly have an hæmoptysis. It is well in these cases every once in a while, to change the diet, by restricting it in amount and modifying it in quality, in the endeavor to lessen the possibly dangerous tension in the lungs.

I was greatly struck with the marked improvement in the case narrated by Dr. Reed, and undoubtedly the diet had much to do with it. Still it seems to me that a large part of the improvement was due to the antipyretic action of the fresh air admitted to the patient's chamber. At Dr. Dettweiler's sanitarium, at Falkenstein, I was struck by seeing the patients kept so constantly out of doors. I had known it was the method, but I had not realized it fully. The patients are kept out doors from early morning until late at night, no matter what the weather, but properly protected from becoming chilled. Fresh air, cool air, is an antipyretic. Unquestionably the admission in this case of Dr. Reed, of fresh air to the chamber, indirectly—perhaps directly—improved the assimilative power of the patient through its salutary effect upon his temperature.

Dr. Von Ruck: Upon the suggestion of Dr. Smith, two years ago, I tried defibrinated blood in perhaps twenty or thirty cases, and wish to state that it has proved of value in improving the blood condition of many of these patients. During its use we carefully observed the number of the corpuscles and the per cent. of hæmoglobin present; and while in some of these patients previous use of preparations of iron had no apparent influence, we found in one case the percentage of hæmoglobin increased from fifty to over one hundred, the number of red blood-corpuscles from 3,300,000 to 5,000,000 and over, and the general improvement of the patient was in proportion.

This was the most striking case. In other cases the result was less

marked, but in most of them an undoubted improvement occurred both as to the blood state and the general nutrition. Of late, we however use peptomangan instead, and find it equally, if not more effective and less troublesome in administration. Of all the remedies heretofore employed by me for the anæmia of phthisical patients I consider defibrinated blood enematas and the use of peptomangan as the most satisfactory, and the latter remedy is not only well borne by the stomach, but improvement in appetite results in many cases so early, and before the blood condition shows improvement, that I believe it to have a direct stimulating effect upon the digestive organs.

Dr. Prentiss: I was unfortunate in not hearing the papers that preceded. From what I can glean I am in perfect accord with the propositions which they state. One point I have seen illustrated this last year. It concerns an experiment in regard to the amount of carbonaceous food. This particular individual is an old gentleman, upward of seventy, a very bright man, one accustomed to close observation. He suffers very much from asthma and bronchitis. He has been experimenting on himself with diet. Last summer he spent the season on the Hudson, and he devoted himself to a trial of the non-carbonaceous diet and its effect upon his lung trouble. This he did for ten days or a week. He put himself on a strict nitrogenous diet: lean meat and certain vegetables that give no carbon. While he was on this non-carbonaceous diet he had no attacks of the asthma and bronchitis. To try the effect of a full diet he went to the hotel table and ate heartily of the ordinary diet. In two days he produced an attack, so that he was certain that it was the return to the carbonaceous diet that produced this attack. The explanation was that the excess of carbon in the system must be eliminated in the lungs by oxidation, and when the lungs are crippled this process of elimination is crippled, and the carbon accumulates in the system unduly; the amount of carbon which must be excreted in this way irritates the lungs. He asked me, in that connection, how I would explain the effect of cod liver oil and the fact that it is beneficial in consumption; according to his idea, the amount of carbon in cod liver oil was excessive. He showed me a handful of charcoal, which he said represented the amount of carbon in one ounce of cod liver oil; the amount of carbon in the oil, I think, is more than one-half. The explanation naturally would be that the carbon in this case goes to nourish the tissues in the form of fat, and is not excreted. This case, the experiments being carefully made, the record carefully kept, and the trial made of returning to the full carbonaceous diet, seemed to me to be instructive.

Dr. Smith: I am much gratified at Dr. von Ruck's report of the use of defibrinated blood. It is a matter of regret to myself that I did

not follow the matter up, as I should have done, some time ago; but to have my opinion so emphatically confirmed by Dr. von Ruck is encouraging. Owing to the difficulty of controlling all the conditions in private practice, it is difficult to carry out the treatment satisfactorily.

Answering the inquiry made, the blood is administered once a day, at bedtime.

Dr. Walker: In connection with Dr. Reed's paper, I am glad to see that he does not advocate exclusively Atlantic City air and nothing else for the management of his cases of phthisis. He uses the change from sea air to mountain air, and in illustration of this he gives the case of the underfed clergyman whom he allowed to go from Atlantic City to the country. It seemed to me very generous treatment.

THE METHODS AND VALUE OF SUPERVISED EXERCISE IN THE PROPHYLAXIS OF PULMONARY PHTHISIS.

By GLENTWORTH R. BUTLER, A.M., M.D.,
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PULMONARY tuberculosis is essentially a disease of defective nutrition. Its immediate microbian factor is universally acknowledged, but underlying the bacillary growth is a certain vulnerability of the tissues. Pathogenic germs require definite conditions for their growth. If the necessary conditions are absent, growth and multiplication cease.

Without question, the tissues of the human body vary in their susceptibility to the advances of the tubercle bacillus. This susceptibility varies in different individuals, and in the same individual at different times. The proof is so obvious that it simply requires mention. The large majority of civilized individuals are exposed to the entrance of the bacilli into different parts of the body, but only the minority, sadly large, to be sure, surrender to the invasion. The fact that pulmonary tuberculosis occurs in a given organism, develops to a given point, and then under changed conditions and environment is arrested, constitutes proof positive of variance in the resisting power of the individual.

Improvement or arrest cannot be credited to specific medication, for specific medication in phthisis is as yet a chimera. A consideration of the anatomical situation of the bacilli in this disease should at once dispel any hope of direct germicidal treatment. Imbedded as they are in thick mucus, fibrous tissue, and epithelial *débris,* and situated somewhere at the

ends of an intricate system of branching tubes, which constantly grow smaller, the mere mechanical difficulties are insuperable. This statement applies not only to nebulized solutions, but to vapors as well. The only way by which vapors enter the air cells is by diffusion, and the mere surface contact of a gas is not sufficient to act as a germicide. The well-known difficulty of sterilizing the external surface of the body in surgical practice bears upon this point. The hard scrubbing and prolonged soaking required is an interesting commentary on the futile attempts at local pulmonary disinfection which are still made.

The nature of immunity—natural, lost, or reacquired—is still a mystery. The terms used to characterize it show themselves a mere begging of the question. Predisposition, proper soil, hypotrophy, vulnerability, involve various hypotheses and somewhat metaphysical speculations, which, while of extreme interest, cannot be claimed to represent exact truth. Biochemical or vital forces have not been weighed or measured except as to their manifestations. Dynamic variations of cell power are not yet visible to the microscope, except in their grosser results. Granting that the essence of life power is unknown, it is nevertheless a convenience to use the terms mentioned.

A certain vulnerability, then, is antecedent to the development of pulmonary tuberculosis. On analysis, all measures directed toward its prevention or arrest act directly or indirectly toward improving the resisting power of the tissues. An exception must be made of those means which tend to lessen the chances of infection—viz., the destruction of bacilli-laden sputa, disinfection of infected rooms, houses, or food, and the limitation of prolonged and close contact with the consumptive.

The measures employed for the prevention or arrest of phthisis may be classified as follows, omitting any form of quarantine or disinfection :

Climate, abode, and outdoor life.

Medication, general and local.

Personal hygiene and habits of life.

Exercise, general and special, with its corollary, rest.

Diet.

I have no intention of specifying the relative importance of these lines of treatment. It is not safe to neglect any one of them, so far as compatible with the circumstances and condition of the patient. Any device or measure that will strengthen and fortify the cells and tissues of the body should be carefully sought after and employed if practicable.

Realizing thoroughly the importance of broad treatment in this as in other diseases, I beg to call particular attention to one of these items—exercise.

I am very firmly convinced from fairly large personal observation that regulated exercise as a therapeutic resource is neglected by many physicians. This neglect does not arise from ignorance, because this subject has been fully and scientifically exploited in various periodical and systematic publications. It is more akin to the feeling with which one regards some of the English classics—as most worthy of regard, but not suited for practical everyday use.

In prescribing exercise the supreme importance of exact attention to detail should be emphasized. It is important in all things, but a matter of necessity in this. The title of a paper by Weir Mitchell may well stick in the mind. "Precision in the Treatment of Chronic Disease" is a most felicitous phrase, and beautifully descriptive of the mental attitude which should exist in the mind of the physician who is treating pulmonary tuberculosis, imminent or acquired.

There are two classes of cases in which exercise is of a peculiar value:

1. The pretubercular status.
2. Incipient tuberculosis.

The boundary lines cannot be laid down with absolute accuracy. The personal equation of the observer is a factor in assigning an individual case to its proper class.

Broadly speaking, the first class comprises those in which the conditions presented give rise to a reasonable probability that phthisis will develop; the second class those in which the

signs and symptoms are such as to show beyond peradventure that tuberculosis exists, but only to an extent that warrants one in terming it "incipient." The classification is a good working formula, if not scientifically correct.

The symptoms and signs, in greater or less number, and to a greater or less degree, presented by the pretubercular status are: Progressive loss of weight, languor, dyspnœa, irregular or absent menstruation, anorexia or capricious appetite, insomnia, tubercular family history, neurasthenia, poor chest expansion, deformity of chest—viz., non-physiological asymmetry or depressions—slight cough, afternoon temperature normal, or 99° F.; finally, absence of decisive pulmonary physical signs.

The symptoms and signs of the second class—incipient phthisis—are so familiar that it is unnecessary to recapitulate them. Hæmoptysis is an event that is well nigh pathognomonic. The physical signs may be so slight as to require the most careful and repeated examinations for their detection, or so well marked that the diagnosis is at once indubitable. The history may include a previous pulmonary or pleuritic affection. The clinical picture should not exceed in its coloring the limitations understood by the term "incipient."

Exercise may be either general or local. The benefits of general exercise may be briefly mentioned: Increase in bulk and strength of muscles, stronger action of heart, improved circulation—arterial, venous, and lymphatic; increase of respiratory capacity, better action of skin, increased depurative functions, improved sleep, appetite, and digestion, and last, but by no means least, a decided bettering of the nervous system. The motor mechanisms of the body are not solely muscular, they are neuro-muscular. Regulated action of the muscles involves the correlative activity of the nerve centres from which they receive their stimuli. Training the nervous system by muscular exercise most certainly improves its functional capacity. When one recalls its varied, complex, and important activities it is readily seen that results of great value may ensue.

This paper is not intended to deal further with the large subject of general exercise, but to treat more particularly of

local or special exercise, which in this connection consists of measures conveniently termed "pulmonary gymnastics."

The direct effect of pulmonary gymnastics is to strengthen the muscles of inspiration and expiration; to increase the size of the thorax, and thereby add materially to the respiratory capacity; to increase the ease and fulness of the pulmonary circulation, and to promote the interchange of gases and the general supply of oxygen to the tissues. According to the rule that full use of any organ adds to its functional energy and structural development, it is properly said that pulmonary exercise brings the vital force of the lungs to its maximum. "Maximum vital force of the lungs" means that the cells of the various tissues composing the lungs are brought to the highest attainable perfection of structure and function, so far as this is dependent on their full and proper use.

The exercises which may be properly termed "pulmonary" are those which bring into special action the muscles of inspiration and expiration, ordinary and extraordinary, and also tend to place the head, neck, shoulders, and thorax into such positional relations that the expansion of the lungs is facilitated and increased. The various modes of pulmonary gymnastics may be classed under the following heads:

Singing and elocution lessons and practice.[1]

Use of wind instruments.

Deep breathing, alone.

Running, climbing, brisk walking, and sports which accelerate the breathing.

Use of compressed or rarefied air, and their combinations.

Military setting-up drill.

Supervised exercises, especially adapted to improve respiratory capacity.

Lessons in singing and elocution involve deep inspiration and regulated expiration. So also does the use of wind instruments. To those who enjoy the practice of these arts there is opened a pleasing and efficacious method of increasing the

[1] Suggested by Dr. A. H. Smith (personal letter).

respiratory capacity. These means are not employed to the extent that is desirable. Practice of this kind has the advantage of securing the willing and persevering adherence of the patient.

Deep breathing alone, repeated a number of times during the day, is very useful, but the direction so to do is usually honored in the breach rather than the observance.

Running, climbing, and fast walking indirectly increase the breathing power. All these, especially running and climbing, are adapted for comparatively few cases, because of the very decided effort and strain which they entail. Moreover, these efforts are apt to be ill-regulated and injudiciously severe. They should never be prescribed without the most minute directions as to time, length, and severity.

Aërotherapy, or the use of air, rarefied or compressed, in varying combinations, is a valuable resource. There is a great variety of apparatus, both simple and complicated, for use in this connection. Some of them aim at an artificial climatotherapy, with differing conditions of density and moisture. Others simply interpolate varying degrees of resistance during the acts of inspiration and expiration. Ordinary breathing tubes and wind instruments ought properly to be classed under this head. There has been much inconclusive writing on this subject. Many of the statements advanced by various observers have a largely speculative character, and do not appear to be based upon experimental findings. There is a lack of control experiments upon the comparative effects of breathing compressed and rarefied air, and forced breathing without apparatus. The relative permanency of these effects is also an open and very important question.

Certain portions of the military setting-up drill are useful in promoting proper carriage of the head, neck, and thorax. Some of the movements as usually practised are more violent than is desirable for persons not in full vigor of health.

Supervised exercise. Under this designation I refer to exercises of various kinds, graduated from time to time to suit the varying requirements of a given case, and practised regu-

larly under the guidance of a competent instructor, lay or medical. This method is by no means new, but has proved of sufficient value in my own work to deserve more than a passing notice. In most of the larger towns and cities it is quite possible, after a little search, to find a competent man or woman, graduated from a reputable school of physical culture, who can be trusted to do this line of gymnastic work. It should be understood that the entire course of treatment is carried on under the general direction of the physician.

The methods pursued are as follows:

Hygienic dress is insisted on, this generally being requisite in the case of female patients.

Regular daily work is required, with simple exercises to be taken at home.

Measurements and tracings of the thorax are made, and the vital capacity ascertained by the spirometer. These records, made at the beginning of treatment, are valuable for purposes of comparison with similar records made at subsequent periods.

After a careful study of the patient's general strength and pathological condition, a certain set of exercises is prescribed. The effort is to adjust the prescription exercise so as to fulfil the indications in the given case. These indications may be:

To correct deformities, depressions, and pathological asymmetries of the thorax.

To increase chest expansion and vital capacity.

To secure permanently deeper breathing by training the neuro-muscular apparatus to habits of ampler rhythmic action.

All of these desirable results I have seen attained.

A certain amount of general exercise is usually given in order to secure the benefits acknowledged to result from it—viz., better appetite and digestion, sounder sleep, healthier condition of the skin and eliminative organs, and improved circulation. As the greater includes the less, a measurable degree of the benefit of general exercise is secured by pulmonary exercise alone.

A large variety of exercise is available, according to the

patient's ability and the results desired. Movements may be active, duplicated, or passive.

An active movement is one accomplished by the patient without the aid of the operator.

A duplicated movement involves resistance to the operator on the part of the patient, or resistance to the patient on the part of the operator. The former is eccentric, the muscle being lengthened while contracting; the latter is concentric, the muscle being shortened while contracting.

A passive movement is performed by the operator, without effort on the part of the patient.

It will readily be seen that exercises of this kind may be graded by very small steps from those which are effortless to those which require more than ordinary strength to execute. Although there is great variation in the outside appearance of many of the exercises they have in common certain underlying aims:

1. To elevate the shoulders.

2. To draw back the clavicles and scapulæ, and thus by traction on the pectorals, to elevate the ribs and expand the thorax.

3. To strengthen the muscles of ordinary inspiration, the diaphragm and intercostals; also the muscles of forced inspiration, the scaleni, sterno-mastoids, trapezius, two serrati, and rhomboids.

4. To strengthen the muscles of forced expiration (ordinary expiration being passive and non-muscular), mainly the abdominal and quadrate muscles.

The third indication—to strengthen the muscles of inspiration—may be considered the most important. It is very desirable that the muscles of the neck, which have been mentioned above, should receive attention. If the muscles running down from the cervical spine to the upper ribs and shoulders are strong and of a good tonus, valuable aid is given to ordinary inspiration.

An example of a passive movement: Patient sitting, operator standing behind; the operator's hands are placed under the axillæ, patient leaning back; the shoulders are then drawn

upward and backward, patient inhaling; then downward to the sides, patient exhaling.

An active movement: Patient, standing, extends arms above head, raises body on toes, inspiring at the same time; then down on heels, exhaling.

A duplicated movement: Patient sitting; operator, standing behind, grasps patient's hands, draws the arms vertically upward against patient's resistance; then patient draws arms down against operator's resistance. This is practically Sylvester's method of artificial respiration.

A good operator will begin moderately; will watch the patient carefully to avoid undue fatigue; will vary and add to the movements as strength is regained or acquired. It is a progressive method.

I beg to report in synopsis four illustrative cases out of a series in which supervised exercise was employed as one of the items of treatment:

Case I.—Physician's daughter, aged twenty-two years. Successive attacks of influenza; no hereditary taint. Loss of flesh, dyspnœa, left chest pain, headache, unrestful sleep, poor circulation. Examination showed infra-clavicular depression and asymmetry of thorax, slight relative dulness at left apex, weak respiratory murmur, and fine crackles on deep inspiration over same area. Fine crackles disappeared after a few deep respirations. Evening temperature, scant 99° F. Lung capacity considerably below normal.

Treatment. General tonics, alimentation, hygienic dress (which was needed), light movements followed by massage.[1] Light work at home. At the end of six weeks tracings showed depressions at left side of thorax nearly obliterated; measurements, that all diameters had increased; average gain in lung capacity, fifty cubic inches; pain gone; sleep normal; appetite above normal. Improvement permanent.

In this case the apices were catarrhal and non-aërated. If tubercular disease was not present, it was at least imminent.

[1] By Miss Marsh, of Brooklyn.

Case II.—Also the daughter of a physician. Hacking cough for some weeks; evening temperature, 100° to 100.5° F. Slight expectoration; slight dulness at both apices, with scanty crackles and moderately harsh breathing, especially on right side, after making due allowance for physiological differences. Expansion poor. Treatment[1] and subsequent history like Case I., but longer continued.

Case III.—A woman, aged twenty-four years. Hæmoptysis small, but extending over several weeks, with previous history of gradual failure of health. Indubitable physical signs of localized apex tuberculosis. Poor expansion and vital capacity. Medical treatment and alimentation were rather unsatisfactory until supervised exercise was added.[2] She remained in good health for a year, when worry and care for a father who died of very chronic phthisis caused a relapse (probable reinfection). The way opened for her to go to California, where she now is, and doing well.

Case IV.—A woman, aged twenty-five years. First seen four years ago with localized right apex tuberculosis of at least eight months' standing. Weight one hundred and eight pounds. Afternoon temperature running 101° to 102° F. Extreme weakness, dyspnœa, anorexia, and insomnia. So well marked was the disease and so unpromising her condition that a considerable sum was paid her by a benefit society, after a careful examination by three physicians, on the ground that her disease would prove inevitably fatal. In this opinion I fully concurred. She was first placed under the "rest cure"—rest, massage, electricity, and super-alimentation. Six weeks of this brought her temperature down and her weight up. Careful management and graduated exercise under my own supervision caused a slow arrest of her disease, and to-day she weighs one hundred and forty-eight pounds, a gain of forty pounds, and the apex lesion, while perceivable, is quiescent.

In this case the exercises were under my personal direction, because at that time I was unacquainted with the great help to be afforded by a competent operator. The patient was unus-

[1] Operator, Miss Lindley, of New York.

[2] By Miss Marsh.

ually tractable and conscientious in carrying out detailed directions. I have found the "rest cure," with or without isolation, an extremely valuable resource in beginning the treatment of somewhat advanced cases.

A distinct advantage of supervised exercise is the moral effect on the patient, by which the regular and persistent use of this means of treatment is assured. Without the stimulus of expected attendance on the operator, prescribed exercises are very apt to be neglected. Under ordinary circumstances most of us cannot afford the time required to properly administer and supervise such exercises. Instruction should be definite, personal, and repeated. Herein lies another value of the trained operator.

The objects of supervised pulmonary exercise, as before formulated, are substantially similar to those of mechanical aërotherapy. The comparative utility of each deserves a word of discussion. Judging from personal observation of cases submitted to both methods, I am convinced that the effects in permanently strengthening the muscles of respiration and increasing the chest capacity are more marked with supervised exercise than with aërotherapy. This statement applies only to the pretubercular and incipient stages. Permanence of effects is obviously extremely desirable. The superiority of one method over the other in this respect is founded upon the differing quantitative muscular efforts required. In pneumotherapy the following combinations may be attained by suitable mechanical devices:

Inspiration of—	Expiration into—	Inspiration is—	Expiration is —
Compressed air	Compressed air.	Passive.	Active.
" "	Rarefied air.	"	Passive.
" "	Atmospheric pressure.	"	"
Rarefied air.	Compressed air.	Active, but expansion is hindered.	Active.
Rarefied air	Rarefied air.	" " "	Passive.
" "	Atmospheric pressure.	" " "	"
Air at atmospheric pressure .	Compressed air.	Active.	Active.
" " " .	Rarefied air.	"	Passive.
Finally, inspiration and expiration of air at atmospheric pressure, as in normal breathing and pulmonary gymnastics.	....	"	"

It will be seen by examination of these combinations that—

(*a*) Inspiration of compressed air is always passive and does not strengthen the muscles of inspiration.

(*b*) Inspiration of rarefied air is active and strengthens the muscles of inspiration ; but the negative pressure of the inhaled air diminishes and hinders chest expansion.

(*c*) Inspiration at atmospheric pressure is active, strengthens the muscles of inspiration, and there is no hindrance to expansion of chest.

(*d*) Expiration into compressed air is the only mode which strengthens the muscles of expiration. Practically this is equivalent to interpolating a greater or less resistance to expiration.

I claim, therefore, that voluntary active inspiration of air at ordinary pressure is the best method of securing permanent improvement in the respiratory capacity, because it is the most efficacious in strengthening the muscles of inspiration. This, in substance, is accomplished by supervised pulmonary exercise.

If it is desired to strengthen especially the muscles of expiration and to cause hyperdistention of the air cells, that end may be attained by the use of the resistance valves of S. Solis-Cohen or Dennison, or even the simple breathing tube. The latter is unscientific because there is no means of varying the resistance.

Facilitation of gaseous interchange and certain circulatory effects are claimed for the use of air at varying pressures. Probably these claims are well founded, although the evidence is largely theoretical. Nevertheless, the continuance of the pressure is comparatively so brief that these effects must be evanescent.

I do not wish to be understood as decrying mechanical aërotherapy. I simply desire to state that with the class of cases dealt with in this paper I have obtained distinctly better and more permanent results with voluntary exercise.

The drawback of supervised exercise is obviously the difficulty of securing expert operators. As before stated, this difficulty does not apply to large cities. With reference to

places where no operator resides, it may be affirmed that a physician who makes himself reasonably familiar with the subject can, by spending some time and trouble, train an available and intelligent person to do this work in a satisfactory manner. The practice of physical culture in the schools is fortunately spreading so rapidly that there are few towns of any size that do not contain some person, man or woman, who has given considerable attention to this subject. Such a one is usually willing to undertake medical gymnastics. Demand creates the supply.

In passing, it may be said that well-planned supervised exercise is extremely useful in other than pulmonary conditions. I have seen excellent results in beginning lateral curvature, stooping shoulders, improper carriage of the body, awkwardness, psychical or congenital, habitual constipation, and disorders of digestion.

As a sample of exercises[1] which may be taken by the patient, where supervision is not attainable, I submit these photographs.[2] These exercises are intended for a person not much below the average strength, but the manner of performance may be modified to suit less vigorous individuals.

The photographs are made from a professional model. Each series represents an exercise; each figure, a phase or movement of the exercise. By noting the successive changes of position and contour from left to right, in connection with the text, a very imperfect idea of the exercise and its effects on the thorax and respiratory muscles may be gained. A personal trial of the movements will give a much more vivid realization of their physiological results.

To formulate conclusions:

1. The treatment of phthisis should be broadly comprehensive, but minute in detail.

2. Among many therapeutic agencies for imminent or incipient phthisis, one of the most useful is respiratory exercise.

[1] Arranged by Miss Jessie A. Lines, Director of Physical Culture, Pratt Institute, Brooklyn, N. Y.

[2] See New York Medical Journal, October 20, 1894.

3. Of all methods of obtaining increase of respiratory strength, capacity, and nutrition, supervised exercise secures the most permanent and lasting results.

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DISCUSSION.

Dr. Otis: I am extremely gratified to listen to this paper of Dr. Butler, because it is so much in the line of a paper which I read before this Association three years ago. I have been so deeply impressed with the importance of carefully supervised physical exercise in the prophylaxis and in the treatment of suitable incipient cases, that it is a great pleasure to have it emphasized. The trouble I find in the application of physical exercise to these cases is more or less ignorance, on the part of many practitioners, of the extreme precision and accuracy with which modern gymnastics are now applied. It is frequently an occurrence to have a patient who is a suitable case for exercise told, in a haphazard way, to "take physical exercise." The physician does not comprehend what that means. He has very little realization of the careful and exact method by which physical exercise is now applied. The last three or four years I have had the opportunity of prescribing physical exercise for about five hundred young men every year. They are carefully examined by strength tests and various measurements. In a large number of instances the contours of the chest are taken in repose and in deep inspiration. The vital capacity of the chest is taken and the ordinary capacity of the chest is obtained. After that they are carefully looked over and exercise prescribed. Then they are handed over to an expert, and he accompanies them at first, and supervises always their exercise.

They generally gain in six months, if they are at all faithful, the results desired. If this careful arrangement of exercises, in the first place, and supervision, in the second place, can be followed with these pre-tubercular and incipient cases, as Dr. Butler has suggested, very much might be obtained. But the majority of practitioners, it seems to me, do not realize fully the necessity of accuracy in prescribing exercise which will enable them to obtain any such results as this. It seems to me, the practitioner who treats any considerable number of cases of phthisis is bound to study the application of chest gymnastics as he would the effect of any drug he uses.

Again, one notices that a great many cases of incipient phthisis in various stages are recommended to take exercise when there is a more or less febrile condition. Now we all know that pyrexia to any extent contra-indicates physical exercise. I have known patients play tennis, for example, who had considerable afternoon rise of temperature. What we need especially to impress upon the physician who treats pulmonary tuberculosis is a study of modern gymnastic methods, and the fact that they are now established upon as careful and as scientific a basis as is the use of any of our drugs. Fortunately, there are in all the large cities, as Dr. Butler has said, graduates of normal schools of gymnastics, of various methods, who are fully capable of directing and supervising careful gymnastic exercise. As these graduates increase, we have the means not only of learning ourselves what can be done, and how, but of commanding for our patients skilful experts who will follow out our directions in the matter of pulmonary gymnastics.

One other point. I think it is most important not only to take the vital capacity by the spirometer, but to take the ordinary capacity and compare the two, not only when you prescribe exercise, but in after-examinations. You will find the difference between the two is *gradually* lessened as the prescribed exercises are followed out, indicating that the patient is using his lung capacity and his thoracic muscles more perfectly than previously.

Dr. Brannan: I should like to express a little more hopefulness than Dr. Otis has done as to the results to be obtained by the general practising physician. I first heard of the idea of pulmonary gymnastics and the value of these gentle exercises some twelve years ago. At that time there was a physician in Boston, not a regular, who had great success in the treatment of advanced cases of phthisis. He pursued some such method as this. I do not think he could have had any very scientific education, but his results were remarkable. I was living then in Colorado, and many of our patients, in spite of the favorable climate of that region, would have unfavorable symptoms; and yet they would return from Boston very much improved after some weeks' treatment under his care. I, myself, in my general

practice in New York, and in my dispensary work, have since then obtained fairly good results by instructing my patients to breathe more deeply. We all find, in teaching physical diagnosis, the difficulty of getting our patients to inhale deeply enough for us to bring out the physical signs for the students. After showing these patients how to breathe, I would often see a permanent improvement in all their physical signs. The difficulty I have always found is in showing them how to do this breathing. I have done it myself in my dispensary work, with a resulting gain in my own chest expansion. It is, however, very fatiguing, when added to the regular routine of the clinic. I am glad to know that we can get men to help us in demonstrating these measures to our patients. I remember the suggestion made to me by a friend of mine some years ago. Her husband had been much benefited by the treatment of this man in Boston, and she suggested to me, laughingly, that if I were in some way to acquire his methods and employ a large, robust man to illustrate them in my office, there would be no question as to my making a fortune in a short time. I never carried out the idea, but at the same time I think there is great value in this method of securing chest expansion.

Dr. Roe: I have been much interested in Dr. Butler's paper. The subject should interest every member of the profession. In the treatment of many diseased conditions, and in those of the respiratory organs in particular, the importance of general physical exercise, in proper amount and kind, should not only be recognized, but should be prescribed and carefully observed, in order that the directions are properly carried out. In addition, however, to this general exercise, so important for increasing and maintaining bodily vigor, I have, in the treatment of pulmonary affections, obtained most excellent results in the employment of special supplementary respiratory exercise by the aid of a pneumatic apparatus especially devised for the inhalation of compressed air. The apparatus which I have devised for this purpose consists of a bellows, very similar to a Biedert apparatus, so arranged that the air before being inhaled is asepticised, so to speak, by passing through a box filled with oakum saturated with creosote. The patient is instructed to empty the lungs as far as possible, and then the bellows is pressed and the chest filled with sterilized air, and sufficient pressure is added to distend forcibly the air cells. In the early stages of phthisis and in cases of unresolved pneumonia or of chronic bronchitis I have had most excellent results by the persistent employment of this method. It is, also, of great service in those cases where the chest is considerably flattened and where respiration is imperfectly performed. I frequently supply the patient with an apparatus of this kind for use at home, so that it can be used once or twice a day or oftener, as is sometimes advisable. This method of forcible inspiration, supplemented by this method of inhaling aseptic

and also medicated air under pressure, has in many cases reopened the closed or obstructed air cells and brought about a healthy condition of the pulmonary structures, which a change of climate and all other methods have failed to do. This method of pulmonary gymnastics will in many cases prove of far more direct benefit to the patient for the expansion of the lungs and development of the chest than any other form of exercise, and should be employed supplementary to the general forms of exercise so admirably described by Dr. Butler in his paper.

Dr. A. H. Smith: This illustrates one phase of an idea that has been prominent in my mind for some time: in the relief of phthisis we are apt to be satisfied if we push one idea pretty vigorously, and to neglect accessory measures. This treatment of Dr. Butler's is perfectly consistent with other forms of treatment being carried on at the same time. It seems to me that very many of our patients would be enormously benefited if we carried out several different lines of treatment at the same time, intelligently applied. All these matters —outdoor life, different methods of alimentation, methods of disinfection of air, and possibly more or less disinfection of the body itself—all these can be carried on simultaneously, and a little benefit from each one might in the aggregate amount to a good deal. We are generally satisfied to push one or two things pretty vigorously, and forget everything else. This certainly seems to me an exceedingly valuable paper, and one which would suggest a resource that could be applied in connection with anything else that would be suitble in a given case.

Dr. Gihon: In connection with the outdoor treatment of consumptives I may mention incidentally the case of a German corporal of marines who, some months ago, was sent to the Naval Hospital in this city, under my charge, with the characteristic symptoms of pulmonary phthisis. He was feeble, emaciated, without appetite, his sleep interfered with by a distressing cough, and with profuse expectoration of bacilli-laden sputa. Learning that he had been an expert practical gardener prior to enlistment I assigned him to light duty in the grounds, for the purpose of keeping him outdoors. He soon became interested in the work, and was so jealous of interference by others that he voluntarily assumed its entire direction, refusing assistance, and passed his entire time in the grounds from daylight until dusk, planting, trimming, using the lawn-mower, sprinkler, etc., in spite of attempts to restrain him, even exposing himself to the occasional inclement weather when not watched. His recovery has been marvellous. His appetite returned, and with it he gained weight and strength. The bacilli disappeared from his sputa, his cough finally ceased, he slept well, and he is now so ruddy and hardy that I shall be compelled to discharge him to his legitimate duties as a soldier,

much as I regret losing the services of so valuable an employé. The exposure to fresh air and sunshine has undoubtedly been the effective therapeutic agent in this case, a lesson I early learned in my naval career, when it was a common practice on long cruises to place chronic invalids and convalescents on the spar-deck or poop, or in the quarter-deck boats, and keep them there when the weather permitted. I have, in a formal paper, on a former occasion given the Association my opinion of the inestimable benefits of ocean therapy, benefits that in a less degree are available in any pleasant, summer outdoor site, removed from local malefic influences.

Dr. Brannan: I should like to ask Dr. Butler a question. This man in Boston had two or three exercises that were supposed to have special reference to the apices of the lungs. One consisted in pressing the abdomen with the hands, and then bending forward so the upper portion of the body was horizontal. I should like to ask Dr. Butler if there is any way of especially reaching the apices of the lungs, which are most in need of air?

THREE YEARS' EXPERIENCE WITH SANITARIUM TREATMENT OF PULMONARY DISEASES NEAR BOSTON.

By VINCENT Y. BOWDITCH, M.D.,
BOSTON.

In presenting to you the results of treatment of pulmonary diseases in the last three years at the Sharon Sanitarium, in Sharon, Mass., near Boston, I do not claim anything strikingly original, but the results obtained thus far are, I feel, of sufficient interest and importance for me to ask your attention for a short time, with the hope of convincing others that similar methods adopted under like conditions may bring forth equally good, even better, results than these.

Some of you may remember that about four years ago at a meeting of this society I mentioned the fact that, through the generosity of wealthy people interested in the scheme, Dr. R. W. Lovett and I had the intention of erecting a small sanitarium for the treatment of people of very limited means (the most difficult class to reach) who were *just beginning* to show signs of tubercular disease of the lungs, and who from lack of means are unable to seek distant health resorts. In that paper I briefly mentioned the various sanitaria now well known to the whole profession, viz.: Goerbersdorf, in Silesia; Falkenstein, near Frankfort-on-the-Main; Dr. von Ruck's, in Asheville, N. C.; Dr. Trudeau's, at Saranac, in the Adirondacks; the Bellevue and Glockner Sanitaria, at Colorado Springs, and others in California.

All of these institutions are more or less remote from our great cities and are situated in climates which in themselves

are considered favorable for consumptives, the exception possibly being Falkenstein, in Germany, which is not many miles from Frankfort-on-the-Main, yet this institution has the advantage of being at a considerable altitude (about 1500 feet above sea-level), and is intended for the wealthier classes.

The Sharon Sanitarium has these distinctive features, and so far as I know is the only one in this country which combines the following conditions, viz.: that it is within easy access of Boston, situated in our New England climate, which is notoriously unfavorable for consumptives, at an altitude of about 400 feet only, and is intended for the use of people of very limited means, like teachers, shop-girls, etc., not for the wealthier classes, and is supported chiefly by public subscriptions.

Our friend and late member of this Association, Dr. Paul Kretzschmar, four or five years ago in two or three papers strongly urged the establishment of these institutions in the vicinity of our great cities, in properly selected healthy regions, and had not his labors been cut short by death I do not doubt that before this some establishment similar to that now in Sharon would have been founded near Brooklyn and New York.[1]

It goes almost without saying, and yet it is a point I especially wish to emphasize, that I have never hoped to obtain such results as are shown by the removal of consumptive patients to more healthful climates than can be found in New England. Such a claim would be foolish in the extreme, but I have been confident that much more could be accomplished than by the usual methods employed in the above-mentioned cases. I am sure there is not a physician before me to-day who, time after time when finding symptoms of incipient pulmonary disease in some excellent young man or woman, has not had the disheartening question come to him, "What can I do to help this patient with little or no money at his or her disposal?" We all know the usual result in such cases. Routine treatment of cod-liver oil, cough syrups, advice to get into

[1] Since beginning to write this paper I have been gratified to hear that a similar project has been started in New York under the guidance of our confrères, Drs. A. L. Loomis and Charles E. Quimby.

the open air, to eat good food, etc., with the knowledge that in the vast majority of cases it means a slow and steady going down hill of the patient. We know too what the result is usually of advising patients to go out into the country to live in the ordinary cheap American boarding-house, with draughty, poorly-warmed rooms, and badly-cooked food. Improvement may come for the time, but the same result follows usually sooner or later. In such cases I have felt for several years, if I only had some place in the country comparatively near, under my control, where people could be under medical supervision with proper hygienic and dietetic treatment, that a good deal more could be done than heretofore to reduce the death-rate from consumption among my poorer patients.

The Sharon Sanitarium is a large wooden building, situated on a high gravelly knoll which slopes toward the south, and is sheltered on the north, west, and east by heavy pine woods. It was built especially for the purpose, and can accommodate at present only nine women patients, but in the future the directors hope to obtain sufficient funds to erect cottages near the present building for the accommodation of both sexes.

It is so constructed as to obtain as much fresh air and sunlight as possible by means of numerous windows and open fireplaces in every room. Each patient has her own special bedroom. Broad piazzas enable the inmates to be much of the time out of doors even in the coldest weather, either walking or lying well wrapped up in reclining chairs.

The interior walls are painted not papered; the floors are of hard wood, both being frequently wiped or mopped with damp cloths, and are never dusted or swept. Rugs, and no fixed carpets, are used.

The strictest rules are made for the destruction of the sputa. Large cuspidors filled with damp sawdust are on the lower floor, and the contents are destroyed by fire. The "Sanitas paper cups" are used at the bedside, and when upon the grounds each patient is provided with a rubber pouch filled with a roll of Japanese paper, which is destroyed also by fire upon the patient's return to the house.

In short, every precaution is taken to prevent possible infection from the chief source of danger, according to our present knowledge, the dried sputa.

Inasmuch as I believe that my hopes have been justified by the results thus far obtained, although the work has been of necessity, up to the present, somewhat limited, I present the following facts for your judgment:

Since the opening of the Sanitarium on February 9, 1891, 51 patients have been received, the comparatively small number being due to the prolonged stay necessary in such cases. 3 patients did not remain long enough to receive treatment, and are therefore not considered. Of the remaining 48, 8 proved to be cases of bronchitis, and were discharged "well."

Of the 40 cases classed as various forms of phthisis, 10 have been discharged as "arrested cases," that is, where cough and expectoration have ceased and the physical symptoms have either disappeared or else have shown the usual signs of a cessation of active processes.

In no case have I used the term "cured," although in the majority of the arrested cases, as far as outward appearances are concerned, the term would have been justifiable, yet the treacherous nature of the disease demands perhaps a longer interval of time before we are justified in using the more absolute term. Several of the patients, however, have been away from Sharom more than a year and a half, and we continue to get the most excellent accounts of their health.

Of these 10 "arrested cases," 2 upon entrance showed signs and gave histories of trouble dating back at least a year or two, and were not what could be classed as strictly "incipient cases." Both lungs were involved in the first of these cases, the disease being more of the fibroid variety, the right lung in the other case being affected with a rather advanced catarrhal form of phthisis. The former, a more advanced case than I now accept at the Sanitarium when possible to avoid it, left the Sanitarium after a stay of a few months with an almost entire lack of abnormal symptoms (*i. e.*, absence of cough, sputa, and fever), feeling "stronger than for nine years previously," and remained in

this condition until about a year ago, when an unfortunate combination of events, viz., swallowing by mistake a dose of ammonia, the presence of two tapeworms, and a severe attack of *la grippe*, so reduced her strength and renewed the old trouble that she applied again for entrance this winter, with an access of pulmonary trouble, which was only partially relieved by a short stay at the Sanitarium.

The other case left Sharon against advice soon after the cough and expectoration were gone, and resumed unfortunately her previous laborious occupation of teaching. She remained, however, in about the same condition for over a year, when she suddenly died after a short illness of two or three days, the nature of which I could not learn from her physician, but she had continued her teaching up to that time, and had seemed in fairly good condition until shortly before her death.

Of the other 8 "arrested cases" I have the most excellent accounts with one exception. She has not communicated with me or her other physician (Dr. J. E. Goldthwait) for over a year, but at last accounts was feeling well, and inasmuch as she promised faithfully to let us know if anything should go wrong we have reason to believe she is doing well, although we have lost sight of her for the present.

All of these cases have been away from the Sanitarium more than a year, most of them nearly two years, with one exception. She was discharged last autumn and is now living in the country, whence she writes most enthusiastically of her "perfect health," "better than ever in her life before."

The details of these cases I shall print with my paper, but forbear to read them now, owing to lack time and for fear of wearying you.

In only 3 of these cases were bacilli found in the sputa, and possibly the results may be challenged in consequence. In reply I can only say that experience has shown us that for months we may examine the sputa in vain to find bacilli, when the physical signs give us the strongest evidence of phthisical disease, and the absence of bacilli is no proof of the absence of incipient tubercular trouble. On the contrary, in all of these

cases many or all of the symptoms which we recognize as those of incipient pulmonary tuberculosis were present, viz., hæmoptysis, cough, sputa, loss of flesh, fever, night-sweats, malaise, variation in the percussion note, respiratory murmur, etc., symptoms in themselves of vastly greater clinical significance to my mind than the mere absence or even presence of bacilli.

Of the 13 cases recorded as "much improved" (by which is meant a marked increase in general strength and weight, marked diminution or cessation of cough and expectoration, with decided improvement in the physical signs), one (No. 33) is soon to leave as an "arrested case," all signs having disappeared, the patient being fat and well after a stay of nearly two years; 1 (No. 31), who had marked signs at the base of the right lung, will probably leave this summer with few or no abnormal symptoms after two years' stay; 1 (No. 49), with hæmoptysis and slight signs in the right lung, has gained 28 pounds in nine months, is the picture of health and strength, and if all continues favorably will be discharged this summer; 1 (No. 42), who entered January, 1893, with a diffuse bronchitis in addition to incipient trouble at the apex of the left lung, has long since shown little or no sign of pulmonary disease, but has been a great sufferer from uterine disease and obliged to undergo a severe surgical operation, and is now at the Vincent Memorial Hospital, in Boston, for that purpose; 1 (No. 50), who entered for hæmoptysis, cough, etc., with slight signs in the right lung, gained 14½ pounds in four and one-half months, the cough and expectoration diminished greatly, and the general condition greatly improved. Having been offered a home in the foothills of California with an aunt, the patient is now there, with a good prospect of recovery; 1 (No. 29), sent by Dr. F. I. Knight, having been nursed through several violent hæmoptyses, during which she nearly died, after a stay of four months and a half left the Sanitarium bright and strong, with marked diminution of all signs, was married and went to live in Boerne, Texas, where she steadily improved, but died lately from puerperal fever.

The foregoing 6 cases and 3 others were "incipient cases,"

while others of those who were "much improved" were in more or less advanced stages of disease.

Bacilli were found in all but two of these cases (Nos. 31 and 33). Both of these cases, however, have had evidences of pulmonary disease, such as hæmoptysis, cough, with sputa; malaise, a loss of flesh, more or less fever, night-sweats, etc., and in 1 (No. 31) marked signs at the base of one lung persisted for months.

Of the 6 classed as "improved," that is, in whom there was some slight amelioration of abnormal symptoms temporarily, 3 (Nos. 12, 16, and 39) were well advanced cases, and 3 (Nos. 31, 43, and 46) were incipient cases, who for various reasons failed to obtain much benefit from their stay, and left Sharon.

Bacilli were found in the sputa of these 6 cases in varying quantities.

Of the 11 cases classed as "not improved," 7 were in far advanced stages of the disease (severe cough, marked emaciation, cavity formation, etc.), 2 had well-marked disease, and 2 were "incipient cases," who went rapidly down hill in spite of all treatment, and left Sharon after a stay of a few months.

In all of these, except 4, bacilli were present in the sputa, and in the cases where they were not found, other evidences of marked pulmonary disease were present.

In looking over these records, then, I think we may feel justified in holding the views already expressed, viz.: That a great deal more can be done than hitherto in the neighborhood of our great cities in harsh climates for this most unfortunate class of patients.

Again, I say that in comparing the results with those obtained in more healthful climates, the percentage of those who are benefited is, of course, much smaller in the former than in the latter case, but that is no reason for hindering our efforts to improve present conditions for those who cannot go far from home.

That present results, moreover, have been accomplished under somewhat adverse circumstances, has its encouraging side, and we feel confident that the experiment is but a stepping-stone to better and more far-reaching results, which can be

obtained chiefly through larger funds, which will surely come as the institution becomes more widely known.

ADVANTAGES OF SANITARIUM TREATMENT. This is an important point, and one upon which I wish to dwell a little.

There is among the community a perfectly natural dislike at first thought toward the idea of bringing a number of consumptive patients together under one roof, as it were. Even among physicians we find this prejudice existing, and before the Sharon Sanitarium was opened it was one of the chief objections in my own mind, so much so that when making visits to celebrated sanitaria, both in this country and in Europe, it was one of my first questions: "What effect do you notice from the proximity of the patients to each other?" In every case I found the objection proved to be practically *nil.*

Doubtless to one casually visiting a sanitarium, where all stages of the disease are received, the effect is at first most sad and depressing, but it has been almost the universal experience of those who have had charge of these institutions that although there may be a certain amount of depression at first, it wears off in a comparatively short time, especially where symptoms of improvement appear. Certainly I can add my testimony to this fact.

On the other hand, the advantage to be obtained from keeping patients under medical control for a longer or shorter period, as contrasted with the haphazard methods of sending them into the country, or even to distant health resorts, to live in hotels or boarding-houses, to follow out their own inclinations—the advantages of the former method, I say, are such that only the most prejudiced observer could deny them.

The ideal way, doubtless, would be for each patient to select his own health resort, away from all invalids, and to keep himself under the sole control of a special physician; but how many of the thousands afflicted with this disease have the means to adopt such measures?

Under sanitarium treatment unfavorable symptoms can be watched more carefully, and prompt measures taken to check them. The regular methods to which the patients become

accustomed are also especially beneficial in their life after discharge, and at Sharon constant endeavors are made to secure other modes of self-support than those in which the trouble began.

It has been the endeavor of the management to receive only such cases as are showing the very earliest symptoms of phthisis, although the rule was infringed in several cases at first before the Sanitarium was well known; then, too, others have entered at the recommendation of physicians who have not realized the full extent of the trouble, and rather extensive disease has been found.

If patients do not improve after a stay of several weeks, or run rapidly down hill, it is always understood among the friends that other measures must be adopted, the reason for this rule being that we do not pretend to make it a hospital for very sick patients, which would defeat the very purpose for which the Sanitarium was founded.[1]

METHODS OF TREATMENT. Hitherto the almost daily visits of efficient medical assistants at the Sanitarium has been a marked factor in obtaining any favorable results, but the constant supervision of a competent resident physician is what we now desire. This I believe to be a necessity for the best results.

The chief aim at the Sanitarium always has been to teach the patients that fresh air and good food are essential for recovery. Judicious exercise, according to the capacity of each patient, is enforced. At first only exercise on the piazza is allowed, until the strength of the patient is tested, and especially if there is a hemorrhagic tendency. Gradually the patient

[1] Dr. S. E. Solly, in his paper on "Climate," in Vol. I. of Hare's System of Therapeutics, gives some elaborate and interesting tables of statistics, the one which bears upon this special point being as follows:

"Comparison between Open Resorts (*i. e.*, hotels, boarding-houses in health resorts) and Sanitariums in Low Climates:

All stages of disease.	No. of cases.	Per cent. cured.	Per cent. benefited.
Open resorts in low climates	1724	6	46
Sanitariums in low climates	2443	13	67½
First stage of disease.			
Open resorts in low climates	625	5	45
Sanitariums in low climates	89	31½	45

is allowed to take longer walks, and finally is advised to ascend the hills slowly, the injunction always being given to *stop before the point of fatigue is reached.* Rest in the open air, even in the coldest days of winter, is a marked feature of the treatment, the patients being wrapped in blankets and allowed to remain for hours in a sheltered portion of the piazza in the sunshine. Drugs are avoided as much as possible, unless it be some tonic to increase the appetite, an aid to digestion, or some simple cough syrup.

The daily or tri-weekly use of the pneumatic cabinet I regard as a most invaluable adjunct in the treatment of all these cases, chiefly from the calisthenic effect upon the chest. I have never seen serious deleterious effects from its judicious use, but on the contrary its power of increasing the amount of expansion and of improving the shape of the chest is very marked. Frequently some soothing vapor is used as an inhalation in connection with it when bronchitis is marked, but this is done as a means of alleviation only. As to the germicidal effect of any vapor within the lungs I have no faith.

Finally, in addition to the cabinet treatment, the patients are taught to take deep inspirations and to hold the breath, expelling it again as far as possible frequently through the day, a method to which too little attention is paid generally in the treatment of any pulmonary disease.

Tuberculin has never been used at Sharon. My experience with several patients at the Carney Hospital, in Boston, just before the Sanitarium was opened, when the excitement over tuberculin was at its height, made me decide that I should try other methods at Sharon until further experiments had been made by Koch himself. I have been much interested in the accounts given of late by Drs. Trudeau and von Ruck of their recent experiments with tuberculin, but although impressed always by what comes from such sources, I do not yet feel wholly convinced of the efficacy of even the modified methods of using this remedy.

I have thus given you, gentlemen, the results of three years' work in a special direction. That the amount accomplished is

small I am well aware, but I can at any rate say I have given you my honest and sincere impressions, and have endeavored, as far as possible, to leave out the so-called "personal equation."

I believe that the highest aim of our profession should be the aid we can give to our fellow-men, and, to accomplish this, the truth and nothing but the truth should be tolerated. Should my conclusions seem to any one unwarranted, I ask only for honest criticism. Certain it is that I feel a pride and pleasure in giving these results, however small, to the American Climatological Association, which has been to me ever since my connection with it, a source of great profit and pleasure.

RECORDS OF TEN "ARRESTED CASES."

CASE I. (No. 1).—American, single, aged forty-six years, typewriter. Entered February 9, 1891. Family history rather consumptive. Never strong. Cough for four or five years, with catarrhal symptoms, loss of flesh and strength, night-sweats, dyspnœa, disturbance of digestion, etc.

Physical examination. Dulness in both apices, most in right. Respiration harsh in both apices, somewhat bronchial in right. Clicking râles in both apices, with sonorous and sibilant râles more or less diffused over the chest. Bacilli in sputa.

Although the case was not one where special improvement was expected, an entire cessation of active symptoms occurred. Cough and expectoration ceased. The temperature was normal. The digestion greatly improved. Patient left at the end of four months and resumed work.

Synopsis. Chronic pulmonary tuberculosis of fibroid variety. Arrest of all active symptoms for over a year, followed by relapse subsequent to an attack of *la grippe,* the presence of two tapeworms and illness from swallowing ammonia by mistake.

CASE II. (No. 3).—American, single, aged twenty-one years, teacher. Entered March 31, 1891. Family history on father's side consumptive. Never strong. Has worked hard. Cough for over a year with occasional hemorrhages. Night-sweats,

some feverishness, slight pain across chest, dyspnœa, anorexia.

Physical examination. Pale. Slight dulness at right apex down to fourth rib, with "crumpling in this region. In right back, dulness slight, and râles throughout. Occasional "crackling" after cough in lower portion. Bacilli in sputa.

At the end of five months all active symptoms had ceased (cough, expectoration, etc.). The physical signs at the end of that time showed a dry condition at the top of the right lung (dry râle after cough, the crackling râles having largely disappeared from the lower portion), the general condition being excellent. Against advice the patient left Sharon and returned to the arduous duties of teaching, which she continued for over a year in abont the same condition, when, after an illness of a few days, she suddenly died, the cause of her death being unknown to the attending physician, who reported her previous condition as good.

Synopsis. Well-marked case of catarrhal pulmonary tuberculosis in right lung. Arrest of all active symptoms for several months, with probable relapse after a year, consequent upon resumption of former arduous occupation. Death, after sudden short illness, fifteen months after discharge. Cause unknown.

Case III. (No. 9).—American, married two years, aged twenty-six years, housewife. Entered June 24, 1891. Family history good. Usually well up to fifteen months previous, when she had *la grippe.* Never well afterward. Cough, sputa, night-sweats, loss of flesh, and other phthisical symptoms. Laryngeal symptoms, aphonia, etc. Entered City Hospital, where tuberculin was used and tracheotomy performed in Dr. George B. Shattuck's service, followed by almost complete cessation of symptoms. Patient entered Sanitarium at the request of Dr. Shattuck.

At time of entrance there was occasional slight cough, with little sputa, marked hoarseness.

Physical examination. Slight dulness at right apex. Harsh breathing in both apices, most marked in right, where it was rather tubular; an occasional dry click in apex, and in lower

right front a few dry râles. Respiration in lower right axillary region rather obscured.

The aperture of the glottis contracted owing to old cicatrices. Epiglottis thickened with cicatrices. The patient steadily improved in every way, and at the end of three months was discharged, September 28, 1891, to go back to her husband, feeling perfectly well, the physical signs showing nothing more than an occasional faint dry click at the end of full inspiration on the right side, and somewhat harsh breathing in the apices.

Since that time the patient has been seen once or twice, and reported a year later that she had no cough, although the last time (about a year ago) she had taken a cold and appeared at my office, and promised if not better she would come again. As she was a most excellent patient, we have every reason to suppose she recovered, as we have not heard since from her.

In this case doubtless the large part of the benefit was due to her stay at the City Hospital, but the treatment at the Sanitarium, I think, served to supplement the good work already done.

Synopsis. Pulmonary and laryngeal phthisis. Use of tuberculin in City Hospital followed by almost complete cessation of symptoms. Cessation of symptoms at the Sanitarium.

CASE IV. (No. 10).—American, single, aged sixteen years. Entered July 1, 1891. Mother died of phthisis one year before. One sister died of hip-disease; others well. Patient well until nine months previous. Phthisical symptoms appeared nine months previous to entrance, after severe overwork and taking cold. Cough, later, sputa, loss of flesh, dyspnœa, malaise, occasional fever, etc.; later hæmoptysis.

Physical examination. Anæmic; sclerotics very clear; thin. Faint clicks in right apex. Once or twice a "squeak" in left apex. Slightly lessened tone in right apex. Signs persisted for several months, and finally disappeared. Hæmoptysis from time to time slight. The cough finally ceased, and on the last examination, about a year after entrance, only a faint dry click could be heard in the apices. The patient left June 29, 1892, at the end of a year, having gained seventeen pounds, and

feeling perfectly well. Since then she has written enthusiastically of her perfect health, and has a healthful occupation away from her former unhealthy surroundings.

Synopsis. Incipient phthisis at both apices. Arrest of disease after twelve months' stay at Sharon.

CASE V. (No. 20).—American, single, aged twenty-five years. Entered October 6, 1891. Sent by Dr. C. Ellery Stedman. Family history not phthisical. Usually well. Began to have malaise about a year and a half before entrance. Intermittent cough for several months. Copious sputa. Pain in right chest at first. Loss of flesh.

Physical examination. Slight dulness at right apex. Suspicion of a râle occasionally there, with broncho-vesicular respiration and increase of voice. Later, faint râles were heard in both apices, which persisted for a time, as well as the dulness in the right apex. Occasional rise of temperature, especially after fatigue; but there was a steady improvement in symptoms, and just before her departure, six months after entrance, the râles had all disappeared; slight dulness at the right apex and prominence of right clavicle persisting.

Synopsis. Signs of incipient phthisis in apices of both lungs. Arrest of disease after six months' stay at Sharon. Cough and sputa disappeared. Gain of twenty-eight pounds. The patient continues to write of her perfect health for the past two years, and has moved from her former damp home to one on higher land.

CASE VI. (No. 24).—American, single, aged nineteen years; factory operative Entered November 29, 1891. History of probable pulmonary disease in the mother's family; the mother, as a young woman, was supposed to have pulmonary disease.

Patient had diphtheria six or seven years previous to entrance, and throat had been delicate since. Fairly well up to four years previous, when she entered a factory where much dust was inhaled, and frequent malaise was complained of. Cough intermittently for two years, mostly in the morning, with rather scanty sputa, occasionally streaked with blood. Once a slight hemorrhage. Pain in the upper portion of chest

on both sides. Anorexia, loss of flesh and strength ; irregular menstruation ; great nervousness.

Physical examination. Except for pallor, a look of weakness, lack of proper expansion of the chest, tenderness on percussion at the apices of both lungs, and later a lessened tone in the left apex, there was little to be found in the chest, but the cough, with occasional bloody expectoration, persisted for some time with varying intensity.

There was a general and steady improvement in all the symptoms ; she gained eight pounds ; the shape and expansion of the chest had markedly improved, and finally, at the end of three months, as the cough and expectoration had ceased and the patient persisted in going, contrary to advice, she was discharged.

Although the physical examination revealed only slight evidence of pulmonary disease, yet the cough and occasional hemorrhages, loss of flesh and strength, with slight fluctuations of temperature, rendered it a very suspicious case, and it was so deemed by Dr. Sheldon, of Lynn, whose patient she had been. She has since married, and at last accounts was very well.

Synopsis. Case with evidences of incipient pulmonary disease (cough, bloody expectoration, loss of flesh and strength, etc.). Arrest of disease.

Case VII. (No. 27).—American, single, aged twenty-eight years, tailoress. Entered April 13, 1892. Family history somewhat phthisical. Never very strong. Subject to cough since fifteen years old. Working hard all winter. Slight cough for several weeks, with bloody sputa and slight hæmoptysis at times. Pain in left front at times. Feverish at first. Dyspnœa ; loss of flesh and strength, etc.

Physical examination. Slight variations in pitch in both apices, with obscure moist râles, and " squeak " in left apex and to a less degree in right apex. In back, obscure " crumple " heard in tops, and extending downward somewhat. The signs persisted, with some variations, for some months, and from time to time there was slight hæmoptysis, but the

râles finally disappeared and the cough and expectoration ceased. Gain of eight and one-half pounds. The patient left the Sanitarium September 28, 1892, at the end of six months, feeling perfectly well, and remained at her home in Canada for the ensuing winter and spring. She has since married, lives in the country, and writes of her perfect health.

Synopsis. Signs of incipient phthisis at both apices. Arrest of disease after six months' treatment at Sharon.

Case VIII. (No. 28).—English, single, aged twenty-three years, domestic. Entered April 14, 1892. Family history favorable. Fairly well up to three years before entrance. Had an attack of bronchitis and general debility; recovered. One year before entrance had severe cold, with tightness and pain across chest, which symptoms persisted up to three months before entrance, when another cold caused a cough, which persisted with scanty expectoration. Loss of flesh and strength. Anorexia. Irregular menstruation.

Physical examination. Pale, with a tired look. Right clavicle prominent. Slight dulness in right apex, with prolonged expiration in front and very faint "crumpling." Just above the line of spine of right scapula a few dry râles. Voice increased in this region. Heart rather rapid. No murmur.

The patient steadily improved after the first month, at times raising some bloody mucus, and left at the end of five months with an entire absence of cough and expectoration, apparently well, the signs in the right apex showing a dried-up process in the lung. She has remained well ever since.

Synopsis. Signs of incipient phthisis at apex of right lung. Arrest of disease after five months' stay at Sharon.

Case IX. (No. 37).—Nova Scotian, single, aged twenty-four years, dressmaker. Entered October 8, 1892. Sent by Dr. R. W. Lovett. Family history negative. Ten months before entrance developed cough after general debility for many months previous. Was in City Hospital, and there had all the symptoms of tubercular trouble in the lungs and intestines, and was sent to the Channing Home to die. Improved greatly, and finally came to Sharon.

Physical examination. Pale, dark under the eyes. Percussion not remarkable. Faint broncho-vesicular respiration, and faint click or crumple upon full inspiration in right apex. In the lower right axillary region fine crepitation, probably pleuritic. The patient gained in weight, and steadily improved in every way. The cough and expectoration ceased, the temperature was normal, and at the last examination the lungs both expanded well, only a few dry râles being heard at the end of long inspiration, with prolonged expiratory murmur, the fine faint crepitation in the lower right axillary region being still present, but less marked than before. The patient felt "perfectly well;" "better than for many years before." She left at the end of four months, and has continued to do well since.

Synopsis. Phthisis involving right lung. Very marked signs, with marked amelioration before entrance. Complete arrest of disease after a stay of four months at the Sanitarium.

Case X. (No. 41).—American, single, aged twenty years. Entered January 14, 1893. Sent by Dr. H. P. Jaques, of Milton. Mother died of phthisis two and a half years before patient's entrance. Mother's family consumptive. Never very strong. Uterine trouble for several years, and dyspeptic symptoms for a long time. Cough began about six or eight months previous to entrance. Improvement upon changing from her damp home to a dry one. Sputa variable, and at times streaked with blood. Night-sweats severe; dyspnœa; acute feverish attack after removal to Milton, where evidences of apparently unresolved pneumonia were found at the base of right lung, behind (dulness, faint bronchial breathing, faint moist râles, etc.). These signs persisted for some time, but slowly improved. Bacilli were found in the sputa. At one time there were questionable faint râles heard in the right apex.

In spite of the marked improvement in the pulmonary symptoms, at the end of seven months the uterine symptoms persisted so markedly I advised operation, and the patient was removed to the N. E. Hospital for Women, where she was relieved almost entirely of her previous dysmenorrhea. The

appetite and digestion after her return to Sharon were "better than ever in her life before," and the cough and expectoration finally ceased entirely, and the temperature became normal. There was a gain of eighteen pounds. After an eleven months' stay the patient went to live in the country with an aunt, who has a healthy, dry house, and she writes enthusiastically of her perfect health. The last examination showed only a shade of dulness in the lower right back. Only after cough could a faint, dry crepitation be heard.

Synopsis. Tuberculosis at base of right lung. Arrest of disease after an eleven months' stay at Sharon.

DISCUSSION.

Dr. Musser: I wish to congratulate Dr. Bowditch on the success of his undertaking and the courage that is exhibited in the conduct of his work. I am sure from my experience, and also I know that the members of this Society are sure, that he is on the right track in the management of this disease. We have reached that time that we can pretty safely say that tuberculosis, if properly managed, is within certain limitations a self-limited disease, and the tendency of the disease under favorable circumstances is to a cure. These circumstances must be largely those which surround an undertaking such as Dr. Bowditch has ventured upon, and therefore such undertakings are always to be encouraged. I regret, indeed, that attempts have been made—in fact, I think the Association within justifiable limits deprecates the attempts—at starting institutions, or sanitariums, for the treatment of tuberculosis within city limits. I do not think anything can be gained by such attempts. Moreover, we, members of this Association, thoroughly appreciate how very important it is that persons conducting such institutions should have—and the profession should demand that they have—proper ideas as to the infectiousness of this disease. For if an institution is not conducted with such principles as a groundwork, it certainly will fail, and will therefore injure institutions which are conducted on the proper principles.

I trust that the gentlemen who propose to start such an institution in New York will be a stimulus to others of us to start similar institutions, for I am sure that we all agree that there is a large field which will result in an immense amount of good in the future.

Dr. von Ruck: The reports which Dr. Bowditch gives us of 25 per cent. of arrested and 33 per cent. of improved cases are such as certainly justify efforts in the direction of institution treatment. I do not think it makes such a very great deal of difference as to the climate in the treatment of this disease; it makes much more difference *how* it is done than *where*. I had myself about ten years ago a small institution in Ohio where fifty-eight patients were treated with about the same results as Dr. Bowditch has obtained. I believe that the ordinary method of sending patients to climatic resorts, leaving them there to consult a physician when they think best, which is usually only when they have a relapse, is bad, and the splendid record shown us here, as well as my own results, not to forget those of Dr. Trudeau, can leave no manner of doubt that management in an institution is by far of greater consequence than the climatic benefits obtainable where the patient is under no control or supervision. I would not, however, have it understood that I place no value upon climate; but I believe it is only one of our aids to recovery, and, valuable as it is, its benefits are not enough to outbalance those resulting from a correct institutional management combined with rational treatment. A combination of all the aids, both climatic and otherwise, gives necessarily the best results, and it is a fact that we cannot deduct even one of our important aids without at the same time jeopardizing and diminishing the ultimate results in a particular case or in a series of cases. In the estimation of this work it is of no consequence whether or not one or another patient has done well with less than we propose; the question is, "How can the greatest number of good results be obtained?" And in deciding upon the needs of a patient who may consult us we must in the light of past experience afford him the best and leave nothing out that can add assurance to his recovery.

Right here I desire to call attention to the fact that the judicious use of tuberculin constitutes also an aid, and with my present experience I believe a very important one, and one that, if my methods and precautions will be observed, is absolutely safe.

If we understand the action of tuberculin, it is that it has a stimulating effect upon the living tubercular tissue, thereby increasing the germicidal effect of the blood serum and the number of leucocytes in the part, thereby increasing the local nutritive processes and aiding the cure in imitation of Nature's own methods. If this local stimulating effect is exceeded by injudiciously large doses, instead of stimulation we produce inflammatory and destructive changes, which, of course, are undesirable, and may sometimes result disastrously. By painstaking observation such effects can be as surely avoided as we can avoid serious results from other poisonous remedies. I have in over fifteen thousand injections been able to avoid them, so that in not one single instance has any undesirable effect been produced by

the remedy. But tuberculin should be used only for the purpose of influencing purely tubercular processes—that is, the living tubercular tissue—and no effect should be expected upon the complications, especially the septic processes of advanced phthisis. It was never intended to act curative in septic fever, which requires entirely different treatment and management, and controls the issue of the case regardless of the coexisting tuberculosis. Unfortunately, tuberculin cannot be safely used unless we can have the patient where we can examine and observe the effects of the remedy continuously; but if so used, it is an aid of great value, and one which I should not feel like abandoning unless something equally good or better was offered me in its place. Under its use my results have improved so that my apparently cured and arrested cases have been doubled when compared with those where the home physicians or patients, from prejudice or other reason, desired me not to employ it; besides, I see relapses much less frequently in discharged cases who were treated with tuberculin than I did before we had this remedy, and since in cases where, for reasons above stated, the remedy was omitted.

DR. QUIMBY: Concerning the hospital in New York to which Dr. Bowditch has referred, I wish to say something in anticipation of criticism. Recently Dr. Loomis told me that I often made such strong statements as to excite doubts as to their accuracy. Nevertheless, I am prepared to claim thus publicly that so far we have accomplished results never before attained in a similar institution. We have succeeded in squeezing the plumber out of not only his illegitimate, but even his legitimate profits, and have brought the other workmen to rock bottom prices. That indicates the work done thus far in this institution. But speaking more seriously, I am deeply interested in Dr. Bowditch's paper. We have talked too much about the treatment of phthisis and too little about the care of phthisical patients.

There is a moral as well as medical aspect of the treatment of disease, and we are bound to consider what may be done to relieve the sufferer as well as cure his disease. I am, therefore, a firm believer in the propriety of establishing hospitals for the home treatment of consumptives, even though they do nothing more than afford relief. The hospital of which I have charge has been started for this purpose—to do all that is possible under the circumstances. With my knowledge of the value of the pneumatic cabinet I have high hopes; but although this hospital is essentially based on pneumatic treatment, it has not been established for the purpose of making a record with selected cases, but to give relief to those whose circumstances prevent anything better. The primary object is to treat that large class of consumptives who cannot get out of the city and who must work while they live. It, therefore, cannot be regarded as a sanitarium; hardly a hospital, but rather primarily a dispensary. We have room for only

twelve or fourteen beds, and they are to be reserved for such patients as are too ill to come for dispensary treatment. I have been quietly working to attain this object for several years, but its present development came as a great surprise to me. Accident brought me in contact with some ladies who were thinking of starting a sanitarium somewhere in the country near New York. I suggested that their efforts be directed first to establishing a place in the city where the thousands who could not get away might have the benefit to be derived from the pneumatic cabinet, and this hospital is the result. It must be evident that in a hospital conducted on the basis above indicated results as measured by the number of *cured* cases must make a poor showing. It will be my purpose, therefore, to have members of the consulting staff examine cases at the beginning of treatment and give a prognosis of what, under the usual methods of treatment, could be expected in such cases. Our results can then be measured by their relations to such prognoses. It is the plan of this institution to have, as soon as possible, a country branch as near New York as a suitable place can be found, where we may be able to supplement cabinet treatment by climatic advantages.

Dr. Curtin: There is one point mentioned by Dr. Bowditch in his valuable paper which suggests to me some experiences I have had in some of my cases of phthisis. He speaks of cases which have all the physical signs and symptoms of ordinary tuberculosis, but where the tubercle bacillus was not found after a careful microscopical examination. These cases have interested me very much. I have studied quite a number of them during the last four years. It seems to me that they have appeared in our midst largely since the introduction of influenza in 1888–89. In the winter of 1888–89 all the cases in the Philadelphia Hospital phthisis ward were found to have bacillary sputum. The next year the influenza appeared, and nearly all the chronic cases of tuberculosis died. In 1891–92, in examining the sputum of the phthisical ward, I was surprised to find that fourteen of the twenty-eight had all the physical signs, but no bacilli. The following year it was about one-fourth. Last year there were four cases in a ward containing about thirty patients that had no microscopical evidence of tubercular disease. A number of these cases died, and I found all the post-mortem evidences of ulceration of the lung, and on examination of the tissue no tubercle bacilli were to be found. I was very much struck with these cases, and it was only a short time ago that I learned that a German bacteriologist had found another bacillus present in these cases, not of the tubercular kind. This seemed to me to be the probable solution of these peculiar cases, which seem to have appeared since the first appearance of the influenza, and almost every case of this kind had a history dating back to an attack of *la grippe*. I have always looked upon them as a result of the pandemic.

PHENOLIC SUBSTANCES:

Nascent Phenic Acid, Carbolic Acid, Creosote, Guaiacol, and Benzoyl of Guaiacol.

By ROLAND G. CURTIN, M.D.,
PHILADELPHIA.

My principal object in reading this paper at this meeting is to elicit a general and full discussion on the use of the phenolic substances in the treatment of pulmonary tuberculosis.

Two papers have been published by the Association, one by Dr. Glasgow, on "Creosote in Pulmonary Diseases," in 1891, and one by Dr. Jacoby, on "Guaiacol in the Treatment of Pulmonary Tuberculosis," in 1892. We have never had a full discussion on the subject at a large meeting, and I am sure the opinion of our members will be received by the outside medical world with gratitude.

DECLAT'S SYRUP OF NASCENT PHENIC ACID.

I have been using DeClat's syrup of nascent phenic acid more or less for fifteen years. The directions for its proper use include the administration of the syrup by the mouth, a gargle for the throat, and a preparation for hypodermatic use.

After repeated attempts to use the remedy hypodermatically I abandoned it altogether. The injections were followed by great suffering, and it was a rarity to find a patient who would allow the subcutaneous treatment to be used for more than a few days. One patient said that death would be preferable to the treatment; another said that he was more content to be comfortable than to be improved by the painful treatment.

The pain was severe at the point of puncture, and often radiated along the course of the nerves toward the body. It was not uncommon to have a painful numbness in the whole limb, lasting for hours.

The most of my patients were treated by the syrup administered by the mouth. To be brief, I will simply state, in a general way, that the results in the improved cases were shown by the following evidences: an increase in weight, diminished cough and expectoration, less dyspnœa, and more strength and appetite. One woman had been incapacitated for work for years, owing to weakness, a result of chronic lung disease she had had for six years. She had a cavity at the left apex. She had come into the hospital to die. In two weeks after the administration of the syrup she had gained six pounds, and had improved in every respect. At the end of two months she left the hospital and took a position as a domestic, and was there a month later, still improving. The improvement in this case was the most marked of any I had under treatment. It illustrates the kind of cases which are most benefited by the internal use of the phenic acid, viz.: chronic phthisis, with slow emaciation and low temperature and poor assimilation of food.

CARBOLIC ACID.

I have tried the ordinary carbolic acid in a number of cases, but it did not seem to do as well as the nascent form (in De Clat's syrup).

CREOSOTE.

Another article of the phenolic class that has long been used by the profession in the treatment of consumption is creosote, but not to the extent it has been since the introduction of beechwood creosote. This was found to contain a larger amount of guaiacol, and this discovery led to the extensive use of guaiacol in tuberculosis; then followed the experiments with the carbonate, iodate, benzoate, and salicylate. These last-mentioned preparations have been used both hypodermatically and by the stomach, but the results have not been universally satisfactory.

Creosote has been administered in large doses, one physician having given as high as 150 drops a day for months without any ill effects, but on the contrary followed by marked good results, results not obtained by smaller dosage. I have given fifty drops a day continuously for over a month, with improvement, which decreased upon diminishing the dose, and in the same ward, and with the same creosote, other patients were injured by doses of five drops, as shown by unpleasant eructations and disordered digestion. If the stomach is disturbed by the creosote, no good results need be expected from its use. Occasionally, though rarely, the use of this remedy is followed by renal irritation, and sometimes by hæmaturia. I have not observed these symptoms in hospital patients, but have now and then observed them in private practice. It has occurred to me that the ill effects might be due to an impure, adulterated, or substituted article. (A druggist once said to me: "It don't make any difference which you put in a mixture, carbolic acid or creosote; they are the same.")

The following are the conclusions arrived at by Dr. J. T. Whittaker in an article in the *Therapeutic Gazette*, July, 1893, page 438:

1. When pure, creosote is harmless.
2. It has no direct action upon the tubercle bacillus.
3. Tuberculosis pulmonum is chiefly a secondary affection by streptococcus.
4. Creosote has no direct action on this streptococcus, hence none whatever on hectic fever.

GUAIACOL.

After long and repeated observations I am satisfied that following the administration of guaiacol in tuberculosis or catarrhal disease of the lungs with high temperature no material benefit is to be expected. The class of cases that seem to be most improved by the use of this medicine is the one in which we have slow progress, slight rise of temperature, and slow digestion with fermentation and poor nutrition. The improvement noticed in these cases may be summed up as follows:

improved digestion and nutrition, and diminished breaking down of the pulmonary tissue, and consequently less expectoration. Guaiacol, creosote, carbolic acid, and phenic acid have been used successfully in the past in the treatment of simple fermentative dyspepsia.

I have observed that guaiacol obtained from different sources is followed by varying results. I am also convinced that some pharmacists substitute creosote where guaiacol has been called for. I have been using guaiacol in the encapsulated and the compressed pill form for the last three years. The benefits of this method of administration are the absence of taste, and it is less irritating to the stomach and is less liable to be followed by unpleeasant eructations. From my experience I should say that guaiacol is beneficial in chronic ulceration of the lungs, no matter whether associated with the tubercle bacillus or not. From this fact I am satisfied that the *guaiacol has no specific effect upon the tubercle bacillus.* I have had ample opportunity to observe in the cases of influenzal phthisis the action of this drug, and I am satisfied that the improvement following its use in these cases was about the same as in tubercular cases. The best results were obtained in patients where the destructive process was slow and the symptoms were mild, very much the same as reported under the head of creosote.

When we take into consideration the chemical composition of these articles, they are found to be much the same, and when used in the treatment of tuberculosis they all seem to act much the same way. In my hands guaiacol has appeared to be the most reliable.

Conclusions: Guaiacol is not irritating to the stomach, nor is it so liable to produce irritation of the kidneys or hæmaturia as creosote.

It has no specific action on the tubercle bacillus, but seems to act beneficially on the digestive tract, improving nutrition, and thereby assisting repair.

Among the advantages of guaiacol over creosote are:

1. Is more easily taken.
2. The process of manufacture insures purity.

3. You know the exact quantity of the medicinal substance you are administering.

BENZOYL OF GUAIACOL.

Prof. Winkle, a German physician, has written an article and given statistics highly extolling the use of benzoyl of guaiacol. A number of cases of advanced phthisis were treated by him, and for the first two or three months they all increased in weight; some continued to improve after that time, while others remained stationary or lost. After reading this paper I used the article quite extensively. Theoretically, this combination should be more successful than simple guaiacol, but I must confess that I found no advantage over the simple guaiacol. I found that almost all cases where the patient eructated the taste of guaiacol the same disagreeable taste followed the use of benzoyl of guaiacol, which is immediately upon reaching the stomach changed into the substances of which it is composed. It is certainly much pleasanter in taste, and is readily made into a compressed pill. The high price is an objection to this drug, as in full dosage the patient would be at considerable expense. My results were not so good as those reported by Dr. Winkle, and the improvement was usually not so marked as after the use of simple guaiacol.

DISCUSSION.

Dr. von Ruck: Some three years ago I used both creosote and guaiacol hypodermatically, with the object of saving the stomach and bringing the remedy directly into the blood. I was then in communication with Dr. Sommerbrod, and used his own creosote, sent me directly by him, as he supposed we were not getting a pure article in this country.

In four patients we were able to continue creosote injections for two months and longer, and about sixty minims were given daily; several other patients dropped out either on account of the profuse sweating and depressing effects of large doses, or because albumin or blood appeared in the urine.

Experiments were made with a view of determining the effect of the creosote treatment upon the tubercle bacilli and their virulency, and pure cultures of bacilli from these patient's sputum were inoculated upon their own sterilized blood-serum. Control cultures from other patients and inoculations of them upon the serum from creosote patients, also inoculation upon sterilized serum from the ox, were made at the same time, and, without going into all the details of those experiments, I found that cultures of tubercle bacilli from creosote patients' sputum grew the same as those from other sources, and were equally virulent whether grown upon the serum from their own blood or that from the ox, and that the tubercular processes induced in inoculated animals were identical in their course and final fatal effect, as were those induced in control animals inoculated from ordinary cultures in which no influence with creosote had been attempted; and I, therefore, feel justified in my belief that creosote has no influence upon the tubercle bacilli, not even when given to the amount of sixty minims per day for two months and over.

Nevertheless, I am convinced from my experience with the remedy that it influences the bronchial catarrh, and catarrhal processes generally, and have frequently seen benefit in this direction as well as in gastric and intestinal derangements; but in the latter instances the remedy must be given in small doses and by the mouth. There being, however, many other and more pleasant remedies for these catarrhal affections equally efficacious, I have almost entirely discontinued the use of creosote in phthisis.

As to the rubbing in of guaiacol into the integument of the abdomen, with a view of reducing fever temperatures, I can confirm its effect in this direction, the same as it will reduce temperature when injected hypodermatically. The effect is, however, irregular, and as the amount absorbed does not stand in relation to the amount rubbed in, it is unreliable; neither is such reduction of temperature desirable with an agent like guaiacol; after some few trials very cautiously made, we noticed collapse from thirty minims rubbed in, while a slightly smaller amount the day previous was followed by only a very temporary and slight reduction. After rubbing in thirty minims (five minims more than on the previous day) the temperature fell from 102° to 95° F., and the patient collapsed, and upon stimulation and reaction the temperature rose to 106.4° F. within an hour. This experience seemed enough for me to abstain from its further use, and confirmed my frequently-expressed opinion that drug antipyretics have no place of value in the treatment of pulmonary tuberculosis.

Although my experienee with creosote has not been especially encouraging, I have within the last year also tried creosote carbonate, but can not say that it has any advantage, except that it was better tolerated by the stomach.

Dr. Loomis: At a previous meeting, last year, I think I said about all I have to say upon this subject. I do not believe that these drugs have any effect upon the pulmonary disease, except so far as they improve the nutrition of the patient by facilitating his digestion. I am quite sure they have no specfic action. I have patients constantly coming to me, fully under the influence of this drug, so the odor can be detected in the breath and the perspiration, who seem to do just as well without it, and, in some instances, better, on account of its prolonged use disturbing the stomach. Whether we shall gain something by the use of the vapor, seems to me still unsettled. We cannot use it hypodermatically. We find no evidence that it has any other effect than to aid assimilation and digestion in a certain class of individuals. By some it is not borne at all. In those who bear it well it has that effect only. In the discussion of this subject last year the majority of those who spoke seemed to favor that view.

Dr. Elsner: Judging from my clinical experience there can be no doubt that in a fair number of cases creosote is of positive value in the treatment of phthisis. While many cases yield but negative results, I have found marked benefit in those forms of mixed infection where an acute pneumonic infiltration is superadded to a latent or active tubercular area. The convalescence to the original condition of the patient, antedating the pneumonia, is ofttimes slow and has in some desperate cases been materially influenced by creosote. In still other cases of chronic phthisis I have used creosote with marked amelioration of the symptoms, particularly cough, expectoration, and accompanying indigestion, with at the same time increase in flesh and strength. Many patients who were sent to the woods have continued the drug, and in conjunction with the climatic change have done well. I do not draw deductions from these cases, as other factors were in all probability more potent in causing improvement than was the creosote. With regard to the presence of the tubercle bacillus and the early diagnosis of pulmonary consumption, I feel justified in saying that it is often made with great difficulty and that the bacillus may be absent from the sputum during the early stages of the disease, and is not so likely to be found until there is more or less disorganization or degeneration of the cheesy infiltrate or tuberculous tissue. There may be a central deposit, beyond the reach of the ear, latent, with occasional acute exacerbations, and yet no bacilli in the sputum, or no sputum at all. If we wait in all cases for the presence of the tubercle bacillus, we will overlook many cases of incipient phthisis.

Guaiacol, in my experience, has not been as reliable as creosote. I have used guaiacol as an antipyretic with variable results. In some cases the fall of temperature has been marked; in other cases no impression was made on the febrile process.

Dr. Loomis: There has been a statement made during this discus-

sion that tubercle bacilli are not found in a certain proportion of cases of early phthisis, because there is no destruction of lung tissue. I should dislike to have that statement go forth without qualification. We do have tubercle bacilli without any structural change in the lung. I have seen a number of instances in which tubercle bacilli were present when there were no physical signs or evidence of disease of the lungs. I offer the following as an example: A young man presented himself at my office one morning. While I was examining him he was seized with a quite profuse hemorrhage. As the hemorrhage ceased I obtained some blood with mucus, and found a large number of tubercle bacilli in it. After complete recovery from the hemorrhage I examined his lungs, and I could find no evidences of pulmonary disease. During all the time that the hemorrhage continued tubercle bacilli were found. This occurred two years ago; there never have been since any physical signs or rational symptoms of phthisis.

The explanation of this case seemed to me to be that tubercle bacilli having entered the bronchi caused local irritation and congestion, which led to the hemorrhage, without causing any structural change in the lung. We know that tubercle bacilli may enter the lung in various ways: through the lymphatics, through the blood-vessels, and through the bronchi; when they enter through the bronchi they cause local irritation first, then a bronchitis; but it may be a long time before there is any destructive change in the lung tissue established. When that change occurs we get the ordinary symptoms and ordinary history of phthisis.

Dr. Elsner: You will pardon me for replying to Dr. Loomis, but it appears to me that the case which the Doctor reports proves almost conclusively that my position with regard to the time when tubercle bacilli were present in the sputum is the correct one. I will use his case to strengthen my position. His patient had bronchial hemorrhage, which, as he says, was profuse, and in the blood bacilli were found. The fact that he had hæmoptysis is positive evidence of the presence of a disorganizing process or degeneration and ultimate erosion of a bronchial vessel. This may have been due to coagulation-necrosis, a breaking down of a punctiform tubercle or some other destructive change, with disorganization in a cheesy infiltrated mass. With hæmoptysis we can be sure of an accompanying tissue-change, and that usually of a destructive character. It is a common occurrence in miliary tuberculosis to have absolutely no tubercle bacilli present in some of the most rapidly fatal cases, until well marked and positive physical signs make the diagnosis of tuberculosis easy. Before this late stage, many able diagnosticians have wavered between the diagnosis of typhoid fever and disseminated tuberculosis. I do not wish to be misunderstood, for I believe that the presence of tubercle

bacilli is proof positive of tuberculosis; their absence does not by any means prove that the disease does not exist.

Dr. Loomis: I did not wish to make my statement a criticism upon the gentleman at all. I am still strongly of the opinion that if a patient has the physical signs of bronchitis, and an examination of the sputum reveals no tubercle bacilli, that I would be unwilling to make the diagnosis of pulmonary tuberculosis.

Dr. Babcock: I have had considerable experience in the use of creosote and guaiacol, and can indorse what has been said as to the inability of many persons to tolerate these substances. In only one case was I able to get the patient to take large amounts. That was a young woman, who gradually increased the dosage to 150 drops in the course of twenty-four hours, with resulting disappearance of symptoms. That was a case in which there had been hæmoptysis, and I was rather doubtful about the administration of it, since hæmoptysis is said to contraindicate the administration of creosote. She came to my office after several months with an entire cessation of symptoms. On account of the irritation of the stomach produced by creosote I have recently taken to prescribing carbonate of creosote—von Heyden's preparation. It is less objectionable, both in smell and taste; and thus far I have found no patient who has been unable to take the remedy, and in many cases the patients have worked up to large daily doses. In three weeks one was able to take 45 drops three times a day; another in ten days was able to take 25 drops before any irritation of the kidneys was produced. It has a decided effect in allaying fermentative processes in the digestive tract, and for this reason possesses great merit. Its chief disadvantage is its cost. It ought to be obtained wholesale for about sixty cents an ounce. It is a thick, oily liquid, and I find the patients are able simply to drop it into a spoon and take it after meals, without any special preparation. It can be taken until the urine becomes of a dark green color, whereupon I order my patients to cut the dose down to one-half, and begin gradually to increase it again.

Dr. Glasgow: I have used creosote for a good many years, and I suppose I have used as large doses as any one in this country. I am surprised to see that it has such a limited hold upon your esteem. I think that anyone who has used it cannot but feel that it is a very valuable remedy. In fact, I consider it, from my experience, to be the most valuable remedy we have against a certain form of consumption. To get any result, I believe it must be used in large doses. There is a great deal of difference of opinion as to the effect of creosote. I have heard and read that creosote has a bad effect upon the kidneys; I have never seen any effect upon the kidneys whatever, and I have used it in doses varying from 2 to 70 drops. I believe that the secret of it is that there is a very differing degree of tolerance of creosote

with different individuals. I have seen persons who could not take one drop without being poisoned. I have seen cases in which 70 drops were taken without any ill effect. I do not give it in capsules or pills ; I always give it in liquid menstruum. The menstruum I have found best is milk. There are certain persons who cannot take milk. and then it must be given in another menstruum.

I have seen striking results from the use of these large doses of creosote in bronchial phthisis or alveolar phthisis. In case of cavities it has seemed to dry up the cavities and diminish the bronchitis.

I have seen no effect upon the bacillus. I have seen cases in which the bacilli seemed to increase. But I believe it does have a marked effect upon the poisonous influence of these micro-organisms. I have seen the patients who take it grow fat and lose the symptoms.

But the great advantage from creosote is in a class of cases mentioned by Dr. Bowditch, a class seen in this country since the advent of the grippe—cases resembling different forms of consumption in all their physical signs ; in some of these cases we also have a local tuberculosis. We find the bacilli ; they continue for a short time and then disappear. I have used creosote in these cases with the most marked benefit. I have seen them become absolutely well under its use, combined with the other remedies which improve nutrition.

I have not only used it through the mouth, but I have seen a great benefit in using it through the diffusion of the vapor in the bed-chamber. I have had some of the best results by using a machine in which the vapor is diffused in the sleeping apartment during the night. I have also used it as an inunction.

I cannot help but feel that creosote is the best remedy I have ever seen, in combination with other remedies which increase nutrition, for the treatment of certain forms of consumption.

Dr. Walker : I am much interested in this subject, especially on account of the objectionable feature of the drug—the odor. Certainly the moment such a patient enters the office his presence is felt. I think it very objectionable so to dose a man that he shall go around having such a decidedly disagreeable odor as he presents ; and whether his skin will take in guaiacol or not, it certainly will give it out. I wanted to see what was the use of the large dose. If these remedies are not antibacillary, what is the use of the enormous doses ? These are the doses which give rise to the offensive results. I believe its only effect is upon the mucous membranes of the body ; it reaches every mucous membrane of the body, with possibly the exception of the uterus, and has a modifying influence. But it is not necessarily given in the extreme doses with the idea that it is going to act on the bacilli. I fully agree with those who think its use is chiefly in its anti-catarrhal influence, in modifying nutrition by influencing the processes, both stomachic and intestinal.

SHALL ANYTHING BE DONE BY LEGAL AUTHORITY TO PREVENT THE SPREAD OF TUBERCULOSIS?

By FREDERICK I. KNIGHT, M.D.,
BOSTON.

It is now twelve years since the infectious nature of tuberculosis, at various times before suspected or believed, was put beyond question, and yet very little has been done in this country to prevent its spread. Physicians recently graduated, and a few older ones who have kept themselves informed of progress in medicine, have enjoined care in the disposal of the sputa, and recently a few have had bulletins of information printed for the use of the sick, or those exposed to them, or both—notably the Pennsylvania Society for the Prevention of Tuberculosis, and Dr. De Lancey Rochester, of Buffalo, N. Y. In 1889 the Board of Health of New York City issued circulars, which were widely distributed, setting forth the communicability of tuberculosis and measures for its prevention. In 1893 the American Public Health Association and the Public Health Section of the Pan-American Medical Congress adopted resolutions in favor of the reporting and registration of all cases of tuberculosis. In September of last year the State Board of Health of Michigan resolved that "hereafter consumption (and other diseases due to the bacillus tuberculosis) shall be included in the official list of diseases dangerous to the public health, requiring notice by householders and physicians to the local health officer as soon as such a disease is recognized." "The purpose of this resolution," as explained by the Secretary of the Board, "is to secure to the local health author-

ities and to the State Board of Health information of the location of each case of well-developed consumption, with the view of placing in the hands of the patient reliable information how to avoid reinfecting himself or herself, and how to avoid giving the disease to others; with the view of placing in the hands of the patient's family, or others most endangered, information how to avoid contracting consumption; also with the view of instructing superintendents of public buildings how to restrict the spread of the disease."

In February of this year the Board of Health of New York City took similar action, but the regulation is not quite so stringent. The circular declares that "the (Health) Department will hereafter register the name, address, sex, and age of every person suffering from tuberculosis in this city, so far as such information can be obtained, and respectfully request that hereafter all physicians forward such information on the postal cards ordinarily employed for reporting cases of contagious disease. This information will be solely for the use of the Department, nor will the Department assume any sanitary surveillance of such patients, unless the patient resides in a tenement-house, boarding-house, or hotel, or unless the attending physician requests that an inspection of the premises be made; and in no case when the person resides in a tenement-house, boarding-house, or hotel, will any action be taken if the physician requests that no visits be made by inspectors, and is willing himself to deliver circulars of information, or furnish such equivalent information as is required to prevent the communication of the disease to others." The resolution provides for the official visitation of tenement-houses, boarding-houses, and hotels where cases of tuberculosis are known to exist, unless the attending physician has assumed the responsibility as above stated. In all cases where it comes to the knowledge of the Department that premises which have been occupied by a consumptive have been vacated by death or removal, an inspector will visit the premises and direct proper disinfection. Rugs, carpets, bedding, etc., are sent away and disinfected without charge. No other persons than those residing there at

the time will be allowed to occupy the premises till the order of the Board has been complied with. The order also provides for free bacteriological examinations, and that all cases in public institutions shall be reported.

The College of Physicians of Philadelphia held a special meeting in January of this year to consider the proposed act of the Board of Health of that city in reference to the registration of tuberculosis. After a long discussion, participated in by a number of the prominent members of the College, the resolution of Dr. Flick, looking to registration and disinfection of houses which have been infected by tuberculosis, and recommending the establishment of a municipal hospital for the treatment of the disease, was rejected, and the following resolutions offered by the Council of the College were passed:

"*Resolved*, That the College of Physicians believes that the attempt to register consumptives and to treat them as the subjects of contagious disease would be adding hardship to the lives of these unfortunates, stamping them as the outcasts of society. In view of the chronic character of the malady, it could not lead to any measures of real value not otherwise attainable.

"That strict attention on the part of physicians in charge of the individual cases, insisting on the disinfection of the sputum and of the rooms, on adequate ventilation, and on the separation of the sick from the well as far as possible, will meet the requirements of the situation, so far as they practically can be met, and better than any rules that, for diseases so chronic, can be carried out by a Board of Health.

"That the College of Physicians respectfully requests that no official action be taken in the matter by the Board of Health, except the insisting on the disinfection of rooms in which consumptives have lived and died in instances in which such procedure is not likely to have been adopted under the direction of the attending physician."

During the past winter a committee was appointed by the Chairman of the Section on Clinical Medicine, Pathology, and Hygiene, of the Massachusetts Medical Society, of which com-

mittee I had the honor to be chairman, to consider what means could be adopted to prevent the spread of tuberculosis in our State. The members of this committee felt that it would be unwise to attempt too much at first, but that the time had certainly come for some kind of an entering wedge, which could be driven deeper as circumstances and the temper of the people seemed to warrant or demand. So we decided to request respectfully the State Board of Health to consider the propriety of issuing a circular declaring the infectious nature of the disease, that the chief danger was from the sputum, and how to take care of this, copies of this circular to be distributed in large numbers to the physicians of the State, and by them placed in the hands of every family where a case of tuberculosis was known to exist. The committee also took the opportunity of expressing their opinion of the desirability of isolating tuberculous patients in hospitals, and the ultimate erection of special hospitals for them. The Board of Health acceded very willingly to the wishes of the committee, and have issued a bulletin setting forth the prevalence of the disease, its nature and mode of prevention, and also a small leaflet of information, which they suggest local Boards of Health to issue, for the use of the patient and his family.

This is about all that has been done. How can this apparent indifference to the most fatal disease in the world be accounted for? Is it that there lingers any doubt about the infectiousness of the disease? I think not, on the part of anyone who has looked at the evidence of it. Though everyone might not admit that every case came from a previous case, he would not, in the face of the evidence, deny such a possibility.

It is hard, in the widespread prevalence of the disease, to get convincing clinical substantiation of what has been so abundantly proven experimentally. The experience of the nurses at Bromptom Hospital is quoted over and over again to prove that the attendants of consumptives have no special liability to contract the disease. The statistics are certainly remarkable, but the statistics of Cornet are equally so on the

other side, who examined the records of thirty-eight nursing societies for twenty-five years, examining the causes of over four thousand deaths, and found that over 62 per cent. died from tuberculosis.

It seems to me that it is to the magnitude of the case that one must look for the cause of the hesitation in grappling with it. The disease is not only widespread, but pursues such a long course that a satisfactory treatment of it (such as we would give a short, acute infectious disease) seems out of the question.

It stands to reason, however, that the State, if it is to take any interest in the health of its people, must not ignore the infectious nature of tuberculosis because it cannot do all it would, but must begin at once and do what it can to limit its spread.

Let us consider for a moment what the State can do at once: 1. It can proclaim the infectious nature of the disease, assuring the people that, inasmuch as the chief danger is from the sputum, if that be destroyed they need have little fear. It can inform them of the best methods of disposal of the sputum, and urge that all sputum in consumptives' houses and in public buildings be so cared for. By this alone probably thousands of lives will be saved. Knowing the danger, people will devise new plans of avoidance for themselves, and thus benefit the State.

Surely our people do not wish to be kept in ignorance, but have established Boards of Health to keep them informed of and protected against danger to their health, as far as possible; and if they find that the authorities have been remiss in this great matter, they may not feel in a liberal mood when asked for future appropriations and concessions.

If the proclamation of the nature of this disease had been longer pressed in its true light in the State of New York I doubt if a tuberculous herd of cattle would have been recently released for want of funds to dispose of them.

2. The State can use the weight of its authority and recommendation for the establishment of special hospitals, whither

thousands who are now a burden at home or improperly cared for at almshouse hospitals are willing and anxious to go. The class of patients which would voluntarily enter the hospital is just the class which, out of the hospital, is most conducive to the spread of the disease. It includes those who are too sick to work, and often too sick to care for themselves personally, and who fall back upon their friends, who are unable to provide for them except by sharing their already overcrowded lodgings, and overtaxing themselves in such a way as to make them easy victims to contagion. Because we cannot isolate all affected subjects is no reason why we should not isolate a part, especially when those left in the community will be those most willing and most able to take care of themselves.

Other methods of combating the disease will come naturally, and be demanded by the people when once they appreciate the gravity of the situation.

Whether our Boards of Health should at once require notification of cases is a question about which opinions will differ. The object of notification, of course, is to insure that from the first every case is surrounded by every known safeguard by one competent and interested to do so. The objection to it has been, first, that it would unnecessarily alarm the patient himself; and secondly, that it would so alarm the family and friends that they would treat him as an outcast.

In regard to the first objection, it will, I think, be admitted by those familiar with the treatment of these cases that those patients with tuberculosis have always done best who have been apprised of the gravity of their condition, especially when this was done early. The late Dr. Henry Bennet, of Mentone, insisted upon this, and then encouraged his patients to make a hard, intelligent fight.

In regard to the second objection—that it would create a panic among the relatives and friends—I do not think this need be seriously considered, if they are told that the careful following of the rules laid down will remove danger almost wholly. Leaving the whole matter in the hands of the family doctor, both in regard to the amount of information to be

given and what precautions shall be taken, cannot be as efficacious as if this was done by an officer of the Board of Health. Unless the family physician was thoroughly believed and was personally interested, it would not be properly done.

It seems unnecessary and unwise to attempt too much at first. It is not necessary in the beginning even to mention all the minor sources of infection, but there is no doubt the State must soon attempt the destruction of tuberculous cattle, for though meat, being usually cooked, is not a great source of danger, milk certainly is.

This Association was founded for the study of climatology and the diseases of the respiratory and circulatory systems. We have more to do with tuberculosis than any other Association. We all know that something ought to be done to give the people the benefit of modern research, and it is our duty so to recommend. Therefore, I shall propose in the business meeting a resolution calling upon all Boards of Health to issue bulletins of instruction in regard to the nature of tuberculosis and the best methods of combating the chief sources of its dissemination, hoping and believing that this will prove an easy entering wedge to more thorough and effectual means of controlling this most destructive disease.[1]

DISCUSSION.

Dr. Bowditch: As I was upon the same committee with Dr. Knight, the opinions he has just given are practically mine also.

At the first meeting of the Suffolk District Society, in Boston, upon this subject, some suggestions were made of classing tuberculosis with

[1] At the business meeting on the day following the reading of this paper the Association passed the following resolution unanimously:

Whereas, The American Climatological Association was founded, among other objects, to promote the study of the nature and treatment of the diseases of the respiratory organs; and

Whereas, Tuberculosis is the most fatal of such diseases; and

Whereas, Modern research has placed this disease among the communicable, and hence, to some extent at least, among the preventable diseases,

Resolved, That this Association do strongly recommend the medical profession of this country to promote measures tending to its prevention.

scarlet fever and diphtheria, against which I strongly protested, for the conditions are entirely different. I think we must act with great caution in this matter, while I believe that great good can come by the *judicious* action of the Board of Health. In this matter, as in every other, there is the happy medium between the two extremes.

The action of the Massachusetts State Board of Health has, I think, been guarded and wise in its recommendations to the medical profession at large.

In cases of death from tuberculosis among the poorer classes I think the local Boards of Health should see that the proper means of disinfection and cleansing are enforced. I sincerely trust that the Climatological Association can take some action in this matter, for I believe great good can come from it.

Dr. von Ruck: I wish to say a word with regard to the contagiousness of consumption by inhalation of dust charged with tubercle bacilli from dried sputum. The relation of exposure and infection to the development of tuberculosis of the lungs is necessarily obscure and different from that observed in the common contagious and infectious diseases, such as diphtheria, scarlet fever, smallpox, etc., in which the outbreak of the disease follows infection after a definite, short period of incubation. Were this the case in tuberculosis, preventive measures would have been adopted and enforced long ago, and there would be no difference of opinion as to their necessity. To the infection of tuberculosis not all people are susceptible, or, if so, the inhalation of the germ may not be followed by symptoms for months or for years, and not until certain conditions arise which are favorable to their further dissemination in the living organism. More recent observations show that even what appear to be well people may have tubercular bronchial glands, and the work done by Dr. H. P. Loomis, in the Loomis Laboratory in New York several years ago, which was recently confirmed by Pizzini, is important to remember in this connection. There is certainly every evidence a reasonable observer could desire, that tuberculosis is communicable from person to person, and those who attempt to deny this or discredit the work of investigators can do so only from either ignorance of the evidence or from a spirit of antagonism which is peculiar to some people who are fond of obstructing the way of scientific truths.

While I am thoroughly in favor of very efficient measures, I do not think that we are ready to adopt rigid legislation, but need to create a proper sentiment on the part of the general practitioner and the general public, in the first place, without which any legislation would be nugatory. This means education and information as to the mode in which the disease is communicated, and the difference between the tubercular infection and contagious diseases like smallpox. Only

after both the profession and a majority of the public are thus informed will wise legislation be possible and effective. In the meanwhile we must do our duty in instructing our patients and their friends properly, and show them how to protect themselves and others; we can also make efforts through the public schools and the press to educate the masses, and in due time proper legislation will become a natural consequence. To make tubercular patients careful of their sputum I am in the habit of making them thoroughly interested parties by showing them that, by their own carelessness, they will reinfect themselves, and pointing out to them that a cure of their disease will be impossible so long as they lay themselves liable to constant reinfection from their own expectoration, and I find this a most efficient way to securing compliance with my rules as to the disposition of expectoration in my institution.

Dr. Brannan: This matter has been under discussion for some time in New York. We were all very much pleased when the State Board of Health in Michigan took its action last autumn, and we were also surprised when we found it had so little trouble. In looking over the case, it seemed to me that it was because it employed the proper term in designating this disease—that is, the word "communicable." Tuberculosis is not a contagious disease, but a communicable disease. That is the word which the Board of Health of Michigan used in speaking of that disease. If we were to use that word, we should not have to reassure our patients that the disease is not contagious in the sense that smallpox, etc., is. The Board of Health of New York has prepared its circular for distribution, and, after the example of the State Board of Health of Michigan, it has chosen the word "communicable."

At the time this matter was discussed last autumn there were two or three organizations working on the same line, among others, the Pennsylvania Society for the Prevention of Tuberculosis. They use the word contagious; there, I think, they are wrong. The Board of Health in Providence also uses the word contagious, but physicians generally will not accept the statement that tuberculosis is a contagious disease. If we take this action, I think we should have it understood that tuberculosis is a communicable disease and should clearly define the method in which it is communicable.

One reason why the physicians in New York City are prepared to support the Board of Health is because of the results which were obtained in its treatment of diphtheria, and the assistance rendered by it to the practising physicians. It has stood ready to examine bacteriologically all cases reported to the Board. It exercises no legal power in the way of compelling the physician to put the case under the care of the Board of Health. When you report a case to the Board of Health it will send an inspector if you wish. If you prefer,

you can get the necessary tubes at the nearest drug store, so that the patient sees no one but the attending physician. The next morning, before you see your patient again, you have heard whether the diphtheria bacilli exist in the throat of your patient, so that you are able to differentiate between cases that are not diphtheria and cases that are.

We were all rather grieved at the position the members of the College of Physicians of Philadelphia felt compelled to take. I presume they were afraid that the Board of Health was going to come in between the attending physician and his patient and put in force measures that none of us here would approve. The office of the Board of Health is to aid the physician, to help him.

DR. HINSDALE: The College of Physicians of Philadelphia is in entire accord with the effort being made to arrest tuberculous disease. The rejection of the resolution referred to was on account of its being too sweeping, and the College favored a modified measure in this regard.

The Philadelphia Society for the Prevention of Tuberculosis has done good work and is heartily indorsed by the profession in Philadelphia. The falling death-rate from consumption in Philadelphia, which has now been observed for some time past, is an evidence that the methods have done good.

DR. CURTIN: It is my opinion that one reason for the recent action of the College of Physicians of Philadelphia is that they are afraid to recommend that additional power be given to the Board of Health, fearing that they may go too far in their measures to check contagious disease. Thers is sometimes a degree of officiousness against which the doctors naturally revolt.

A friend of mine was treating a case of diphtheria. He reported it as the law required, and the Health Inspector called at the house He looked at the case and, turning to the mother of the child, asked "What is the doctor swabbing the throat with?" "He isn't swabbing it with anything," replied the mother. "My Heavens, isn't he swabbing the throat?" exclaimed the Inspector. "No," replied the mother. And then she anxiously inquired "Should he?" "Oh, well," answered the Inspector, "I'm not allowed to say anything."

This is an example of what we have had to contend with in Philadelphia. I would give a Board of Health like that of Massachusetts full power to act; but with most Boards such power would be misused, and react, not only on the physicians, but also on the public, which the laws are intended to protect, and this will continue as long as the Boards and appointees are responsible only to political parties.

DR. WALKER: I am very certain the profession in Philadelphia would be a unit on the measures which Dr. Knight says the Boston Association have adopted. I know Dr. Hinsdale and Dr. Curtin will bear me out. It was not only the method which the Board assumes

of sending a young medical inspector, in spite of your report that you will and have taken all the necessary measures to prevent the spread—it was not only that, but it was the undue enthusiasm of the originator of the movement, who wanted to carry out extreme measures, advocating that which would be proper in a hospital, but not in the ordinary household treatment of the disease, which influenced the action of the College of Physicians.

A dissemination of the knowledge of the contagiousness of phthisis should not be confined to those houses where the disease already exists, it should be universal. Let the well know that phthisis is a communicable disease. This information should extend not only to houses where the disease already exists, but to those who are liable to be exposed to this poison in public conveyances everywhere. Let such knowledge be disseminated to every household in the land. If we can do that, I should be much in favor of it.

DR. WEBER: I believe the resolution is timely and by no means too severe. Before all, it is necessary to disseminate knowledge; and this resolution requests the Boards of Health of the different cities of our country to disseminate knowledge, and to issue orders, if necessary. The objection that is so often made on the part of the people, and also on the part of practitioners, that it seems to stamp the consumptive as an outcast, is irrelevant and does not hold good. The people may not be wise, and common sense may not go as far as it ought; but, in the long run, the people are just and to be trusted. They are well aware that the patient is not responsible for his disease. The feeling of sympathy for the consumptive would overmatch any feeling of terror or depression that the people might have for him, if their knowledge about the contagiousness of tuberculosis was greater than it now is. I, therefore, think that the resolution of Dr. Knight is not only not severe, but as mild as it could be made in the face of the present knowledge.

DR. SMITH: I think that the resolution read by Dr. Knight might go a little further, with profit, in the way of assuring the public that casual meeting or association with phthisical patients does not involve danger. Wherever this question has been discussed by the newspapers, the attitude taken was that we were putting the patient in the condition of a leper. It was not a question of house infection or of sputum, but the man himself was to be the subject of suspicion, and to be avoided as you would avoid a leper. If we were positively, not inferentially, to combat that idea, I think it would be an improvement.

DR. GLASGOW: I think this resolution is very mild. It simply advises the Boards of Health to disseminate knowledge and to take certain precautions. I do not believe that consumption is contagious in the way that has been proclaimed during the last year. It is abso-

lutely against my own experience. I believe that the consumptive germ is communicable to certain people, but to others it is harmless. If we take our experience as physicians, we can say that consumption, as a rule, is not contagious, except under certain conditions. I recollect going into a family of the poorer class where a man was lying in bed and expectorating upon bits of newspaper. The place was filled with a large family of children. That sputa was in the most favorable condition for doing evil; it remained there, became dry. Yet not a single member of the family was infected. Take the experience of the German sanitarium of Gorbersdorf, as related by Dr. Brehner himself. In this village, where the sanitarium has long existed, and there ought to be a great spread of consumption, there has been a less percentage of deaths from consumption than before the sanitarium was established. Ten thousand consumptives received treatment in the sanitarium between the years 1854 and 1880. They promenade freely in the village, expectorating in the streets, and mix with the inhabitants, and although the village has increased 50 per cent. in population since 1854, the mortality from consumption amongst the inhabitants has fallen from 0.40 to 0.18 per cent. We know that tuberculosis can be developed in certain animals through inoculation with the bacillus; but the susceptibility of the human being and the conditions under which inoculation will take place have not yet been positively established. These radical measures should be considered, and considered a long time, before we recommend them. I think, also, that it would be laying a sort of stigma upon consumptives; it would injure them by depressing them morally. Dr. Knight's resolution, however, is so mild that I think that I could vote for that.

Dr. Knight: I am sorry that the Chairman of the Massachusetts State Board of Health came in so late that he did not hear my paper. I am sure that he is heartily in accord with it.

Dr. Walcott: I have nothing really to say beyond what Dr. Knight has said with reference to the action of the State Board of Health. I need hardly call the attention of the gentlemen to the fact that consumption has always occupied a very prominent place in the mind of the Board of Health of Massachusetts. It was practically in connection with the Board that the late Dr. Henry I. Bowditch did the epoch-making work which has remained to this time one of the most important contributions to the study of tuberculosis. The Board has not been willing, in considering this matter, to go into any general directions beyond the advice of the leaflet that Dr. Knight has referred to. We do not believe that the disease ought to be placed, at present, in the same class with the more actively communicable diseases. We do not believe it is desirable to attract so much attention to the individual cases as official investigations are always likely to attract, and we do not see how you can safely go beyond the New

York method without falling into the defects which appear to have accompanied Philadelphia's method.

If your local Board of Health is going to assume any power whatever in connection with these cases of tuberculosis, I do not see how they can stop short of assuming all power. That is the tendency of boards of health everywhere. It should be distinctly understood that they are simply going to furnish assistance to the physicians of the country. If they assume this work as part of the public health function, they have no right to hesitate to say, in certain cases, that the treatment is improper, and to undertake interferences that would certainly be annoying to the attending physician and possibly of no service to the patient. I should be sorry to see the matter made a part of the business of the State and local boards of health in the same fashion as the more actively communicable diseases. I think the suggestion of Dr. Knight is the most useful method of approaching this question.

Dr. Smith: I was interested in the paper by Dr. Knight. It puts the burden of responsibility for the prevention of tuberculosis upon us individually.

Dr. Knight: I can only say that I am much pleased with the unanimity with which this resolution has been accepted, and I hope that the gentlemen will all feel in the same state of mind to-morrow at the business meeting.

With reference to Dr. Smith's suggestion, it seems to me that might be left to the boards of health in the issue of circulars. It is sufficient, I think, to ask the boards of health of the country to issue such circulars as they see fit; but if it seems best to you to make that statement, it can be made to-morrow when the resolution comes up.

REPORT OF CASES OF CHRONIC HEART DISEASE TREATED BY THE SCHOTT METHOD OF BATHS AND GYMNASTICS.

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From a therapeutic standpoint, cardiac diseases may be divided into three groups:

1. Those in which a disappearance of signs and symptoms follows treatment, and a cure may be said to result.

2. Those cases in which treatment preserves or restores compensation, and the individuals are thereby enabled to enjoy added years of life and usefulness.

3. Those distressing cases beyond hope of more than transient relief of symptoms and in which the ablest therapeutic management cannot restore compensation.

For the most part, the first group is made up of cases of inorganic heart disease; whereas, structural diseases of the heart, whether valvular or confined to the myocardium, constitute the other two.

To the second group, furthermore, belong those cases with loss of compensation in what Fraentzel terms the first and second degrees. Cases in which lack of compensation has reached the third or extreme degree, and in which there is hope of but temporary relief of the most distressing symptoms, comprise the third group. Prior to the time of the great Stokes, when cardiac hypertrophy was treated by venesection and other depleting measures, patients with heart disease were doubtless often brought prematurely into this third degree of lost compensation. Not only do more enlightened methods

preserve patients from a mismanagement that would hasten them into a loss of compensation, but it is to be hoped that in the future a more advanced therapeutic knowledge will preserve a still greater number from entering this third and fatal group, or will be able to restore compensation in cases now considered past all such possibility.

The aim of this report is to direct attention to the value of certain baths and light exercises in cardiac therapeutics, by which it is believed patients suffering with organic heart disease of chronic nature may be more promptly and lastingly improved than by drugs. As the employment of mountain climbing in the treatment of cardiac affections is called the "Oertel method," so this is often spoken of as the "Schott method," because of the important work in this line done by two German physicians—Dr. August Schott, now dead, and Dr. Theodore Schott, of Frankfort. Many, if not all, of the members of this Association are acquainted with the method through the latter's published accounts of his twenty years' experience, or possibly through my paper on the subject that appeared in the columns of the *Journal of the American Medical Association* of November 11, 1893. Therefore, a repetition of what I narrated at that time would be tiresome; yet a brief statement of the rationale of this system of cardiac therapeutics may serve to emphasize the results of the treatment shown by the annexed case reports.

The baths owe their efficacy chiefly to free carbonic acid and the two salts of sodium and calcium chloride, the other saline ingredients of the natural waters of Bad-Nauheim being present in too limited amounts to do more than lend feeble aid to the effect exerted by those named.

The next important feature of the baths is their temperature. Warm baths are debilitating and exert a decidedly weakening effect upon the heart even in health. They are recognized, therefore, as inadmissible in the treatment of diseased hearts.

Accordingly, the temperature of these baths ranges between 92° or 93° F. at first, and 87° F., or a little lower, toward the end of a course of treatment. At these temperatures baths

are cool, and even at 92° F. impart a distinct feeling of chilliness as patients enter them.

The duration of each bath is limited, and is increased cautiously with the progress of the treatment and improvement of the patient's condition. From five or eight minutes as the initial limit, baths gradually reach a duration of twenty minutes.

But one bath is given daily, and this is omitted altogether every fourth day. A course of treatment extends through six or seven weeks ; baths are then discontinued for about a month, after which they may be resumed if the patient's condition indicates their renewal.

After each bath the patient is required to lie down and rest for at least an hour, that the influence exerted on the heart by the bath may not be counteracted by that of exercise.

If the pulse of the patient be watched during the bath, it will be found to become slower, fuller, and stronger, and, if irregular in rhythm before, it is likely to improve even to the extent of attaining perfect regularity. Efforts on the part of the bather, such as speaking, forced breathing, moving about, etc., generally occasion temporary irregularity and acceleration of his pulse. The respirations are generally slow and deep, partly in consequence of a feeling of oppression of the chest experienced by most individuals. This sensation of weight is not complained of by all in equal degree, however, and it is usually lost after a few baths. The improvement in the rate and quality of the pulse is an index of the degree of benefit derived by the patient. If not counteracted by exercise, this effect on the pulse will persist for an hour or two subsequently. Changes for the better in the size of the area of cardiac dulness and in the sounds may be noted likewise. This was demonstrated repeatedly last year, both on myself by a competent Russian physician, and by myself on others. Careful percussion immediately before and after a bath of eighteen to twenty minutes' duration showed a demonstrable retraction of the deep limits of cardiac dulness, and the heart sounds were improved in strength, the second pulmonary being less accentuated, the

second aortic stronger; in short, the abnormal difference between the two sounds before, being appreciably less marked after the bath. Murmurs that are almost inaudible before become intensified; and conversely, some loud bruits are lessened in intensity. In short, so far as can be determined by physical examination, these baths appear to lessen the rapidity and increase the force of the heart's contractions, thereby occasioning a better filling of the great arterial system, with a corresponding depletion of the engorged veins. This is borne out by experiments on animals conducted by Dr. August Schott, which demonstrated, by means of a mercurial manometer placed in the trachea, that a rise of arterial pressure was the result of nearly complete immersion in a saline solution.[1] In this respect, therefore, the effect of these baths is similar to that following the administration of digitalis; both lengthen diastole and augment the force of systole. In addition, digitalis exerts a powerful influence as a vasomotor constrictor, which action sometimes offsets its beneficial effect on the heart. This action on the vascular system is felt by all the arteries alike. Herein, as it seems to me, lies the difference between the effect produced by digitalis and that exerted by these baths. Experiments have demonstrated that the contraction of cutaneous vessels effected by cold baths occasions, at first, increase of blood pressure and of the frequency and strength of the heart's contractions, but that later on the acceleration gives place to a retardation of the rate.[2] The pulse, therefore, becomes slower and stronger during a cold bath, provided this be not continued until vasomotor paresis sets in. Thus far a cold bath of moderate duration affects the heart in its contractions similarly to digitalis, although the mechanism by which this result is accomplished differs. On the other hand, Schüler[3] has shown that the application of cold to the abdomen, that is, contraction of the cutaneous vessels of the abdomen, is

[1] Five to ten millimeters with a 10 per cent. salt solution, and ten, twenty, thirty millimeters with carbonated water.

[2] Von Ziemsen's Handbook of General Therapeutics, vol. iv., p. 286 et seq.

[3] Op. cit.

followed by prompt dilatation of the vessels of the pia mater; whereas heat applied to the abdomen is succeeded by constriction of the vessels of the pia mater. From these experiments, it is probable that the effect of a cold bath is not to cause contraction of internal as well as of cutaneous vessels, but that a cold bath is followed by dilatation of internal vessels. In short, during and after a cold bath of moderate length the heart contracts more slowly and forcibly. Furthermore, although there is not a *consensus* of opinion as to the balneological effect of mineral waters, whether or not their saline and gaseous constituents serve as mild stimuli to the sensory nerves of the integument, it is probable, as remarked by Leichtenstern,[1] that they act as vasomotor dilators, since cutaneous redness follows their prolonged use in degrees of considerable strength.

From the foregoing facts, and from empirical knowledge of the beneficial effect of a balneological treatment of many cases of heart disease, I venture to deduce the following as the *modus operandi* of these baths:

Upon a patient's entering the bath there is an initial or primary constriction of the cutaneous vessels, produced by the cold. This is promptly followed by a dilatation of the internal vessels and stimulation of the heart; its contractions, at first perhaps accelerated, become subsequently reduced in rate and augmented in force. After a moment or two the sensation of chilliness gives place to one of warmth, when it is probable the contraction of the cutaneous vessels grows less; the gentle stimulation of the sensory cutaneous nerves produced by the salts serves, however, to maintain the increased energy in the cardiac contractions. This secondary feeling of warmth does not act like a primary application of heat to the surface of the body by causing contraction of internal vessels; their dilatation persists, as is shown by sphygmographic tracings. A tracing was taken immediately before the bath; a second tracing, taken after the patient had been in the bath ten minutes, bears slight but unmistakable testimony to increased

[1] Op. cit.

fulness and force of the pulse during the bath, without increased tension, while there is nothing to suggest the slightly lessened tension being due to diminished energy of the left ventricle.

Under these conditions the heart not only has less labor to perform, but it is actually aided in the accomplishment of its decreased task. Like digitalis, the baths slow and strengthen the cardiac contractions; but, unlike digitalis, they dilate rather than contract the arterial system; or, in other words, reduce rather than increase peripheral resistance.

The light exercises—or, as the Schott brothers choose to designate this part of their cardiac therapeutics, the gymnastics—are an extremely simple but important adjunct to the baths. They consist of movements of flexion, extension, and rotation of the extremities and trunk, but the individuality of this treatment lies in the application of counter-resistance made by an attendant trained for that purpose. He must see to it that the movements are performed slowly and steadily, that they are interrupted by short periods of repose, and that the effort exerted by the patient is not so great as to cause embarrassment of respiration or undue acceleration of the pulse. The attendant must watch lest the patient hold his breath, and thereby overstrain the already feeble right ventricle, and must at once call a halt upon evidence of dyspnœa. Finally, he must so apply his counter-pressure as to offer resistance, but not hinder free movement of the extremity. This requires some judgment and skill, yet is not so difficult as to be beyond the acquirement of an intelligent friend or relative, who can then help the patient to continue his exercises indefinitely after the latter has passed from the physician's daily superintendence.

These exercises exert an effect on the heart and circulation similar to that of the baths, and therefore supplement and reinforce the balneological treatment. If properly performed, and if the resistance be judiciously apportioned to the patient's endurance, these gymnastics slow the rate and augment the force and volume of the pulse, as has been repeatedly shown by the sphygmograph and sphygmomanometer. Percussion and auscultation reveal the same improvement in the size of the

dilated heart and in the character of its sounds as after a bath. Patients not infrequently comment on their feeling of *euphoria* succeeding this form of treatment; dull præcordial pain, discomfort, or sense of oppression gives place to a condition of ease and light-heartedness. On the other hand, if too great resistance be applied, there is produced a sensation of cardiac distention with variable degree of dyspnœa, while the pulse grows more rapid and feebler. Improved arterial circulation is so manifest a result of these exercises that Dr. Schott has known them to lessen the frequency, nay, even the severity of attacks of angina pectoris in individuals with arterio-sclerosis who had been unable to indulge in even very moderate physical exercise taken in the ordinary ways of walking, etc.; permanent amelioration of the sufferer's condition has been achieved in some of these cases.

Report of Cases. Between November 1, 1893, and May 1, 1894, nineteen cases of chronic heart disease have been treated by me according to this method, nine males and ten females, classified as follows:

No. 1. Male, aged sixty-five years. Insufficiency of mitral valves, marked dilatation of both ventricles, first degree of loss of compensation; moderate and tractable diabetes mellitus.

No. 2. Male, aged forty-seven years. Insufficiency of mitral valves, compensation slightly disturbed; anæmia; corpulence.

No. 3. Male, aged forty-four years. Insufficiency of mitral valves due to Graves's disease; cardiac and thyroid, but not ocular signs present.

No. 4. Male, aged thirty-six years. Idiopathic enlargement of the heart, loss of compensation, third degree; great hepatic engorgement, slight œdema about ankles; urine of congestion.

No. 5. Male, aged fifty-five years. Idiopathic enlargement of the heart mainly of left ventricle, with murmur of relative mitral insufficiency, second degree of loss of compensation; moderate arterio-sclerosis; no discoverable disease of the kidneys.

No. 6. Male, aged thirty-nine years. Idiopathic enlarge-

ment of the heart with threatened loss of compensation; no discoverable arterio-sclerosis or renal disease.

No. 7. Male, aged thirty-eight years. Stenosis of the mitral orifice; first degree of loss of compensation.

No. 8. Male, aged fifty-three years. Idiopathic enlargement of the heart, stage of dilatation; second degree of loss of compensation; chronic interstitial nephritis; hypertrophic sclerosis of the liver; small effusion in right pleural cavity; arhythmia cordis.

No. 9. Male, aged sixty-one years. Dilatation and probable degeneration of left ventricle with relative mitral insufficiency; first degree of loss of compensation; moderate arterio-sclerosis; chronic bronchitis.

No. 10. Female, aged eleven and a half years. Insufficiency of mitral valves, first degree of loss of compensation; passive congestion of liver and spleen; old-standing pleuritic adhesion over the right lower lobe.

No. 11. Female, aged forty-five years. Stenosis of mitral orifice, first degree of loss of compensation; marked hepatic enlargement from hyperæmia; no discoverable chronic nephritis.

No. 12. Female, aged twenty-one years. Insufficiency of mitral valves, first degree of loss of compensation; anæmia; chronic gastritis due to congestion.

No. 13. Female, aged eighteen years. Relative insufficiency of mitral valve, with first degree of loss of compensation; chlorosis, hæmoglobin 19 per cent.

No. 14. Female, aged twenty-eight years. Insufficiency of mitral valves, compensation threatened; hypochondriasis.

No. 15. Female, aged twenty-two years. Pronounced stenosis of mitral orifice: first degree of loss of compensation.

No. 16. Female, aged twenty-five years. Insufficiency of mitral valves due to chronic endocarditis, but intensified by anæmia, first degree of loss of compensation.

No. 17. Female, aged thirty-four years. Chronic endocarditis of mitral and aortic valves, insufficiency of mitral predominating; stenosis of aortic orifice preventing free regurgitation; first degree of loss of compensation.

No. 18. Female, aged fifty-nine years. Idiopathic enlargement of heart, in stage of dilatation, first degree of loss of compensation; moderate arterio-sclerosis; no chronic nephritis demonstrable.

No. 19. Female, aged thirty-four years. Moderate stenosis of aortic orifice and feebleness of left ventricle, complicating chronic interstitial nephritis; slight œdema of ankles and face.

Of these cases, Nos. 3, 4, 9, 11, 16, and 17 did not, for one reason or another, complete a full course of treatment. No. 3 discontinued treatment because of its interference with his employment. His baths were taken irregularly, and no effect for better or worse could be detected.

No. 4 was obliged to abandon treatment at the end of one week because of marked increase of symptoms due to the fatigue of his daily journey to and from the bath-rooms. As this patient persisted in taking long and tiresome walks to the extent of producing great cardiac distress, it is not unreasonable to attribute the aggravation of his symptoms to imprudent exertion rather than to the baths.

No. 9 declared the baths produced some sense of comfort and well-being, but he gave them up because of contracting a cold during the inclement weather of November and his decision, therefore, to postpone the completion of the course until warm weather.

No. 11 was not amenable to control to the extent of abandoning social pleasures that were manifestly injurious. At first she seemed to experience slight improvement, but subsequently ascites developed, and I discontinued the baths.

No. 16 derived such a degree of benefit that, at the end of two weeks, she suddenly decided to stop all treatment and remove to another city.

No. 17 was obliged, for family reasons, to leave the city for her distant home, at the end of a week. She was so sure that the baths were already beginning to help her that she left with the full determination of a return for treatment in the early summer.

The remaining thirteen cases have all shown more or less

improvement, both on physical examination of the heart and by the sphygmograph. Without exception, they have acknowledged the benefit received. Improvement has generally been first noticed by a lessening of dyspnœa on exertion. Cardiac pain and discomfort have likewise been relieved or removed.

No. 8 seemed at the end of three or four weeks to be deriving appreciable amelioration of dyspnœa. His color improved, and a sphygmographic tracing showed slight but distinct improvement in the irregularity of the pulse. At the close of six weeks, however, his condition suddenly grew worse, and ascites, which had been a symptom two or three years before, again developed and caused him reluctantly to abandon treatment.

No. 13, the case of mitral regurgitation due to chlorosis, received treatment also by Blaud's pills, cathartics, and salol; but without special effect on the chlorosis. Yet such was the relief of her heart symptoms that, after the close of the balneological treatment, she resumed work as a nurse-girl.

Excepting in this case, no general or cardiac tonics were prescribed, cathartics and gastro-intestinal antiseptics only being occasionally ordered *pro re nata.*

Nos. 1, 7, 18, and 19 are under treatment at the present writing.

The following three cases are given in detail:

CASE I. This is the one numbered six in the list given above. This patient, who is a very busy druggist engaged in large business interests, has been a patient of mine ever since March, 1889. There was no history of inflammatory rheumatism or other disease to lead to chronic endocarditis. He was always of high temper, abstained strictly from alcohol and tobacco, acknowledged venereal excess, but without syphilis, and gave history of overstrain of heart and several attacks of partial and complete syncope. There were at that time dilatation of the left ventricle, apex being situated half an inch outside of left mammillary line, a soft mitral systolic murmur, but no marked enlargement of the right ventricle and no demonstrable engorgement of liver or spleen. Pulse was somewhat

accelerated, and at times irregular and intermittent. Urine analysis revealed moderate diminution of water, solids, and urea; a trace of albumin, but no casts. The peripheral arteries were not sclerotic. I regarded it as a case of dilatation of the left ventricle due immediately to strain, and the murmur as relative. For the following four and a half years he was under rather fitful treatment and kept at business, although at times with a very intermittent pulse. Last November his heart's action was so feeble and irregular in time, as well as force and volume, that I decided to submit him to a trial of the Schott method. Since then he has taken two seven-weeks' courses of the baths and kept up daily gymnastics.

November 6, 1893. Examination of heart; apex beat, fifth interspace a little outside nipple line; epigastric pulsation slight; right border two inches from right sternal margin, total transverse diameter seven and three-eighths inches; slight hepatic enlargement from passive hyperæmia; soft mitral systolic murmur transmitted to middle of axilla, accentuated second aortic and prolonged second pulmonary sound; in dorsal decubitus, murmur rather replaces the feeble first sound.

At the end of one week of baths, patient states there is increased urination.

December 11, 1893. Patient is delighted with the baths and declares he is better. Yet, if there is any improvement I am surprised, for he is constantly subjected to physical and mental strain and the worry of great business and family perplexities.

January 5, 1894. Pulse not intermittent, and patient asserts he would not know he had a heart. Apex beat in fifth interspace, nipple line fairly strong and rather thrusting; dulness on right side deep, as determined by auscultatory percussion, one inch to right of sternum; superficial limit normal; mitral systolic murmur scarcely audible, and first sound beginning to have more of the muscular element; second aortic sound much stronger than second pulmonary.

24*th*. Pulse again irregular and somewhat intermittent, but the first heart sound is of fairly good strength, and the murmur

scarcely audible. Although not in quite as good condition as when he stopped the first course of baths, the heart is still in far better condition than three months ago.

March 31. Pulse regular, 77, and at the end of a minute there was only an intimation of a skip.

May 4. Pulse not intermittent, fairly regular in force and volume; apex beat of fair strength, one-fourth inch to left of nipple, and auscultatory percussion shows deep cardiac dulness to extend one and three-eighths inches to right of sternum.

Patient denies any cardiac symptoms. Although the heart measures less transversely, particularly at the right, than in November, 1893, it is more dilated than at the end of patient's second course of baths. Considering this man's wilful and persistent over-taxation of his weakened and perhaps degenerated heart, I am greatly gratified by the results obtained. Of the sphygmographic tracings exhibited, the first was taken on December 4, 1893, after the patient had taken four weeks of baths. The second was taken March 9, 1894, just before his bath, toward the end of his second course of balneological treatment, and the third half an hour later, immediately following the bath.

CASE II. (No. 10 of the list of cases.)—Patient first examined October 13, 1893, female, aged between eleven and twelve years, very thin, small of stature, Irish-American. History of diphtheria at seven, followed by scarlatina, two attacks of chorea, repeated attacks of inflammatory rheumatism; very ill last spring with "swelling of ankles;" is troubled with weakness, palpitations; subject to cough, but none at present; anorexia, bowels regular, sleep poor.

Physical examination. Pulse 100, weak, small, and uneven; chest small and shoulders droop forward; noticeable fulness of right posterior base and left anterior base of thorax, so that the longest diameter is from right infra-scapular to left mammary region. Slight dulness of right infra-scapular region, and still slighter impairment of left infra-clavicular region. Respiratory sounds vesicular on right side with few pleuritic exudation râles at base behind, and in left infra-clavicular region breath

sounds are distinctly puerile. Heart: Apex beat in sixth interspace, half an inch outside of left mammary line; a diffused heaving impulse from fifth to seventh interspaces; short thrill at apex, becoming distinctly presystolic in *dorsal decubitus;* slight epigastric pulsation; deep cardiac dulness extends from one and three-eighths inches to right of sternum transversely to three inches to left of sternum; both sounds distinct, second at apex split and second pulmonary reduplicated and ringing; a rasping, rather short murmur over sternum that is transmitted to left; posteriorly, a murmur that is distinctly systolic, but anteriorly the murmur not synchronous apparently with either sound; murmur loudest over mid-sternum; in *dorsal decubitus* murmur becomes loud at apex and seems to follow second sound; sounds and murmur at apex have a rolling rhythm. The tachycardia was such as to make me somewhat uncertain of the exact condition. Lower hepatic border rounded and not tender, plainly felt an inch or more below costal arch; splenic dulness also increased.

The tachycardia was such as to make a positive interpretation of the cardiac bruits rather difficult; but I felt sure of the existence of insufficiency of the mitral valves. The harsh murmur over the body of the sternum seemed to me diastolic.

Baths were advised, and about a month subsequently they were begun and kept up regularly for seven weeks, notwithstanding the often inclement weather and the necessity of the patient's journeying forty miles by rail to and fro.

November 23, 1893. Total transverse cardiac dulness, four and three-eighths inches; right border one and three-eighths inches from mid-sternal line, and apex-beat one-half inch outside of left nipple in sixth interspace and diffused.

December 11. Baths are agreeing with patient; she sleeps well, has good appetite, her color is improved, and her mother thinks she has gained some in weight; heart's action less rapid, impulse strong, and pulse more regular in force and volume.

January 13, 1894. Apex in sixth interspace, nipple line; impulse less diffused and rate 105; right border of heart, on

auscultatory percussion, one inch from mid-sternal line; murmurs, plainly a blowing diastolic over body of sternum, and loud mitral systolic with short rough presystolic murmur. The patient had gained nine pounds in weight, and showed greatly improved color of lips and cheeks.

The sphygmographic tracings shown are indicative of the improvement. The first, taken November, 1893, the day she began her baths, shows by its respiratory curves the dyspnœa, all trace of which has disappeared in the second, taken at the close of treatment.

A letter from her father, of May 3d, contains the following statement of her condition during the winter:

"Nellie's condition at present is not very good. She contracted a cold a few days ago, and it settled on one lung. At present she is feeling very poorly, and has no appetite, but up to that time she got along very nicely, and was going to school up to last Friday. I called in Dr. S. to see her Monday; he said one of her lungs was filled up, but thought the condition of her heart was greatly improved. He had not examined her since she took your treatment."

Case III.—This patient (No. 12 of the preceding list) consulted me on January 17, 1894, with view to trying the Schott method. She was twenty-two years of age, tall, slender, a Norwegian, assisted her mother in attention to their store customers; family history negative; patient had measles in early childhood, scarlatina at eleven, subacute rheumatism of right knee three years ago and repeated one year ago; first noticed shortness of breath two years ago; examined by me a year ago, at which time I diagnosticated stenosis of mitral orifice; is musical and sings a good deal, being troubled with palpitation of heart if she holds a sustained note; has præcordial pain and sensation of "heart being in the throat" when exercising; appetite good, bowels and menses regular, no œdema and no renal disease.

Physical examination. Præcordium somewhat bulging; apex beat in fifth interspace, on left mammary line, strong and preceded by prolonged thrill; epigastric pulsation. Auscul-

tatory percussion showed that the deep limit of right ventricle at level of fourth sterno-costal articulation was one and seven-eighths inches to right of the right margin of the sternum, and from this point dulness extended to left a transverse distance of five and three-eighths inches to the line of the nipple. Lower hepatic border reached two finger-breadths below costal arch, and splenic dulness extended upward to level of upper border of eighth rib mid-axillary line. On auscultation, the first sound at apex was short and thumping, second sound feeble, and immediately after the second sound a loud, rough murmur began and remained audible until the next succeeding first sound; this presystolic murmur was not propagated to the left, and no systolic murmur was anywhere or at any time audible. In repose the pulse was 75, very small and tense, but regular. The diagnosis, then, of uncomplicated stenosis of the *ostium venosum sinistrum* was confirmed, there being slight loss of compensation.

She commenced treatment five days later, and in all took seven weeks of baths and gymnastics; took no medicine and attended as usual to her duties in the shop. On March 6th occurs the following entry: No baths since March 2d, salt fish for supper that evening caused indigestion, at midnight cardiac palpitation, cough, and dyspnœa. Border of right ventricle seven-eighths of an inch to right of sternum; apex strong and strong epigastric pulsation.

On April 3d, at close of balneological treatment, patient declared she had lost her præcordial pain and distress on exertion, and, indeed, was not troubled with dyspnœa on ordinary exercise. Examination of heart corroborated the retraction of right ventricle noted in March.

The tracings exhibited show the improvement in the character of the pulse, and explain themselves. The first was taken before, the second after the course of baths.

The baths exerted no appreciable effect upon the cardiac murmur, but a fair degree of compensatory hypertrophy of the right ventricle became established. The patient expressed herself as being much pleased with the results.

In conclusion, I desire to speak briefly of the contra-indications to this form of treatment. There can be no doubt of its dangers in degenerative changes of the bloodvessels and myocardium, such as aneurism and advanced arterio-sclerosis, acute softening, and great fatty degeneration of the heart. In these conditions rupture might result from heightened intra-vascular and intra-cardiac pressure.

Furthermore, the query has been made as to whether chronic interstitial nephritis is not also a contra-indication, on account mainly of the danger of setting up acute inflammation of the kidneys. It might be urged, in the second place, that the increased vascular tension produced could prove disastrous by augmenting the heightened arterial tension already existing.

To the former objection I can reply that when Dr. Schott was questioned on this point he stated he did not consider chronic interstitial nephritis a contra-indication to the baths. It would seem as if the stimulating action on the skin of the salts and carbonic acid rendered the effect on the kidneys different from that of a bath in plain water at the same low temperatures.

As regards the dangerous augmentation of existing vascular tension to the extent of either rupture of a bloodvessel or of stretching the cavity of the left ventricle, I would suggest that such baths should not be administered so long as the hypertrophied heart was adequate to the peripheral resistance to be overcome.

They should be given only when the cardiac energy was threatening to fail or had actually failed. Under such circumstances the only thing that could preserve the patient would be a restoration of the heart's power. This might be possible if the heart-walls were not too degenerated and the kidneys not greatly contracted. Moreover, if the baths in question bring about even a slight degree of dilatation of the internal vessels, then the peripheral resistance would be lessened rather than increased, and if the circulation were thereby improved, so likewise would be the action of the kidneys.

In the case of great cardiac dilatation associated with chronic

interstitial nephritis (Case No. 8) the patient was in such a grave condition from cardiac weakness that the treatment was undertaken as a *dernier ressort* after the patient had been made acquainted with the possibilities for evil and warned that benefit was not likely.

It is a question for discussion as to whether or not the return of his ascites was directly due to the baths. Acute nephritis was not set up.

The two following urine analyses in the case of the female patient with chronic interstitial nephritis and aortic stenosis are of interest as bearing on the effect of these cool baths on damaged kidneys. The first was made two or three weeks before she began the baths, and the other, May 21st, was during her fourth week of baths, when she was getting a temperature of 89° F. for fifteen minutes. Nitrogenous food is now practically eliminated from her dietary, which was not the case before she came under my charge.

ANALYSES.

	First.	*Second.*
Total amount	1650 c.c.	1400 c.c.
Specific gravity	1009	1015
Reaction	Faintly acid.	Acid.
Albumin	Small amount, $^{1}/_{40}$th by weight.	A trace.
Sugar	None.	None.
Urea	3½ grains per ounce.	7.2 grains per ounce.
Epithelia		Vaginal and renal.
Casts	Few medium sized hyaline, one partly granular.	Few medium sized granular.

ON SOME PATHOLOGICAL CONDITIONS OF THE HEART IN DIABETES, AND THEIR RELATIONS TO DIABETIC COMA.

By LEONARD WEBER, M.D.
NEW YORK.

I have had under observation and treatment between fifty and sixty cases of diabetes mellitus, and kept a clinical history of most of them ; the far greater number of them were private, about half a dozen only being hospital cases. As to sex, they are pretty evenly divided among men and women, who were generally over forty-five years of age when I first saw them, though the disease antedated the beginning of my own observation of most of the cases by two or more years. Only four concerned persons between twenty and thirty years of age, one of whom, a merchant, the son of a physician who died of diabetes, had all the symptoms of true diabetes fourteen years ago, but the disease became latent after a while. The man regained his health, and is now apparently well, though I do not know whether his urine is free from sugar at the present time or not. And two cases in children, both girls, between eight and twelve years of age; one of them was attacked with diabetes after severe scarlatina, and died within three months under the symptoms of phthisis tuberculosa acutissima; in the other the disease came on a few months after acute bromism, caused by taking an ounce or more of bromide of potassium within thirty-six hours. In this girl's case interstitial nephritis developed pretty early in the course of the disease, progressing rapidly to a fatal termination, and she died about eighteen months after the commencement of her trouble, both kidneys

being found reduced to the size of horse-chestnuts. A history of the last two cases was published by me in the *American Journal of Obstetrics and Diseases of Women and Children* some years ago. Of the forty odd cases of diabetes in advanced life, none of them got well, though I have known many of them to exist comfortably and be able to pursue business by living up to certain rules and regulations suitable to their individualities for a number of years, one as long as twenty and quite a number for about ten years after I first saw them. Seven cases of diabetes I count among my office clientele at the present time.

Among the causes of death I have noted intercurrent and consecutive diseases, such as gangrene, pneumonia, and nephritis particularly, but at least half the number died of acute or subacute diabetic coma. Of the seven cases yet under observation, one presents an anomalous history:

Mr. S. K., aged sixty-four years, married, merchant, came first under my treatment about twenty-five years ago for an old fistula in the left lumbar region, leading about five inches upward toward the vertebræ, the probe not disclosing the presence of bone disease. By cleansing, scraping, and injection with mild sulphate of copper solution, the fistula finally closed, and remained closed these many years. At least fifteen years ago he began with albuminuria, and has passed albumin in pretty large quantities ever since. Two years ago, in summer, he was taken ill with some gastric disturbance and slight fever, and presently began to drink more water than usual, lose in weight, and to show two per cent. of sugar in his urine. The presence of sugar is not as yet permanent in his case, but it frequently appears, and three months ago the man's old fistula broke open again and discharged some thin pus.

This development of glycosuria in the progress of renal albuminuria is not an isolated observation in modern medical literature, but it is the first case of the kind that has occurred in my practice.

Now, in coming to the subject of my paper—the state of the heart in diabetes and its relation to diabetic coma—it is

well known to me that Frerichs already drew attention to it, and there are, besides, some recent papers out concerning the matter, especially one by Jacques Meyer, of Carlsbad, also by others, I believe. I have not had the opportunity to read any of these, neither have I collected any special literature to present to you, but simply bring before you my own observations made at the bedside, and ask you to compare them in the ensuing discussion with your own. After attending about half a dozen diabetics who died in coma I had to notice that there were marked differences as to the premonitory symptoms, to the manner of the onslaught or development, and to duration, the termination being fatal in every well-marked case. The difference in kind and degree of coma appears to depend upon the relative potency of the factors that are mainly active in bringing it about.

Where the heart has grown weary, dilated, or its muscle diseased—often so when consecutive Bright's disease or arterial sclerosis is present in diabetes—*collapse coma* may take place without any of the symptoms of acid intoxication of the blood by diacetic and acetone acids, usually made noticeable by the well-marked acetone odor of the patient's breath. I have seen three cases of this kind not accompanied by much temperature or other symptoms of intoxication, but simply syncope followed by speedy cardiac death. This cardiac form of diabetic coma is certainly not as frequent as the other caused *by acid intoxication*, nevertheless heart disease in consequence of diabetes is not so rare as might be thought, and surely potent enough in itself to cause sudden death.

The last case of the kind I observed in an old lady who had had diabetes for at least fifteen years of her life to my own knowledge, and who died a few months ago, seventy-three years old. During the last three years of the disease her heart showed increasing weakness and disturbed innervation, her pulse being never more than 24 to 26 a minute, and sometimes as low as 16 to 18. Symptoms of acid intoxication she had scarcely any, and finally there was just a little rise of temperature, a little more feebleness and irregularity of the

pulse, and she passed away, remaining conscious almost to the last.

Her husband, on the contrary, who had always been well and active up to his seventy-second year, developed acute diabetes all of a sudden, with 6 to 8 per cent. of sugar in his urine sometimes, and presented the well-marked symptoms of acetone poisoning prior to an acute attack of bronchitis, became comatose, and remained more or less unconscious for a week until he died at the age of seventy-four. His heart never showed any symptoms.

The causes of neuro-muscular disease of the cardiac organ in diabetes are manifold, I believe. We have in the first place the wear and tear of the heart by a generally long disease producing functional weakness and predisposing it to dilatation and atrophy, fatty overgrowth, and later on, perhaps, fatty degeneration in the diabetes of fat persons, the poisonous effects of acetone and diacetic acid upon cardiac nerve and muscle, besides the poisonous effects of ptomaïnes produced by the putrefactive processes in the alimentary canal in course of the rather frequent attacks of gastro-intestinal dyspepsia of diabetic patients. Also concomitant or consecutive disease in the form of nephritis and arterial sclerosis plays no small part in affecting the heart and changing a previously good prognosis as to further duration of life at once to a serious or grave one. Is not in chronic nephritis also the state and nutrition and functional activity of the heart of the utmost importance with regard to the management and prognosis of the case? I know it to be so, and have had occasion to speak upon this point in a paper "On the Value of Creosote in the Treatment of Surgical Kidney," read elsewhere and published in the *Medical Record*, December, 1893. To take care of the diabetic's heart seems to me, after my experience, just as important as to pay attention to his dietary and keep his alimentary canal clean and in order, to prevent intoxication of the blood by acids and ptomaïnes with its baneful symptoms, and ward off the dreaded coma as long as may be. Fortunately for the patient, the indications for the one condition are not contra-

indications for the other, if properly understood. And this brings me to the prophylaxis of diabetic coma and treatment of diabetes by proper management of the diabetic patient, of which permit me to speak briefly before closing my paper. The course of diabetes in the majority of cases is chronic, but it may also be acute, even very acute. The transition from the one to the other stage has been verified in numberless observations; but, unfortunately, our position in the judgment of the progress of a given case that we undertake to treat is not so certain as it might be presumed to be, because it is so difficult to understand correctly the individual disposition and imminent power of resistance of the various organs and the entire system. Worms, in a second paper "On the Treatment of Slowly Progressive Diabetes," read before the Academy of Medicine, maintains that none of the prevalent theories on the pathogenesis of diabetes is fully verified by clinical observation, and that it might be called a personal, protean-like disease which can be brought about by the most varied causes.

I am prepared to endorse Worms' statement. Although I have among my cases many where this or that organ seemed to be particularly affected, as, for instance, diabetes with cirrhotic hypertrophy followed by shrinking of the hepatic organ; a case of malignant disease of the pancreas with and two others without glycosuria; brain disease and locomotor ataxia with well-marked diabetic symptoms; a case of severe constitutional syphilis in the course of which acute diabetes developed, and some cases in which there seemed to me a causal connection between arterial sclerosis and diabetes, yet I could not pronounce this case the hepatogenic, that the neurogenic, and that the pancreatogenic form of diabetes, because neither of them would give satisfaction when I had taken into consideration all the other constitutional symptoms of the patients.

If such is the case, our task will be to treat the diabetic individual prophylactically by taking care of his heart and his alimentary canal, to save him from coma, and directly by reducing his glycosuria as much as possible. It is some years since I first observed that one or another of my diabetic patients

who had an already weak heart or was prone to attacks of gastro-intestinal dyspepsia was made worse apparently by continuance of a strict nitrogenous diet, and that after getting better of what might be called an attack of latent coma by appropriate treatment, got along better by allowing an amount of carbo-hydrates just sufficient for his individual requirements, yet not so large as to increase the glycosuria. In a statistical report Stephen Mackenzie states that out of eighty diabetics in Guy's Hospital forty-five died suddenly, and that it was important to observe that the pretty frequent gastric disturbances in the course of an absolute meat diet appeared to precipitate coma.

There is an increasing opposition among medical men to absolute meat diet and exclusion of all carbohydrates in the treatment of diabetes, and it appears that those have better results in the management of the disease who will not blindly follow an absolute system, but, after careful consideration of all the patient's history, adapt their therapeutics to his individual requirements. Cantani, who was, and Naunyn, who still is, one of the principal champions in Europe of an absolute diet, are opposed by Seegen, F. Meyer, Gans, and others, and Gans, who has seen much and observed it well, said some time ago that if he was to choose for himself between an absolute meat diet and go on with diabetes and die, he would choose the latter. There is a doctor in Marburg, Germany, Kuelz by name, a man in good professional standing, who has in recent years made quite a reputation for himself as to special ability in managing diabetes successfully. He uses no secret remedies nor much in the shape of medicine, but tries to get as minute a history of his patient's case and constitutional and life history as he can, and adapts his treatment to the requirements indicated by the same, but never follows an absolute meat diet.

In every case that presents itself where I see no contraindication to its being done, I try to get the sugar out of the urine by two or three weeks' absolute diet, rest, massage, and bicarbonate of sodium and salicylate of sodium, fifteen grains each, three times daily before meals. That being accomplished, I

then try to find out how much carbohydrates my patient can take and digest, and have found this amount to vary between two and three ounces a day, which he is then allowed to have.

The alkaline treatment in the above-mentioned form, or as Carlsbad mineral waters, is then continued.

If the soda solutions do not agree with the patient, I give small doses of opium, after the manner of Pavy. Always being on the lookout for the condition of the patient's stomach, bowels, and heart, I use the well-known remedies to fulfil symptomatic indications, having frequent recourse to baths, to massage, and, when there is cardiac weakness or cardiac muscular disease, to Schott's method of treatment by baths and resisted movements, the particulars of which you have heard from another speaker.

In diabetic coma I have purged the bowels thoroughly, and then filled the lower colon with alkaline water, injected hypodermatically soda and salt solutions, also used various excitants, etc., to stimulate the heart's action, but so far have seen no case of recovery.

DISCUSSION.

Dr. Butler: I was very much interested in Dr. Weber's paper. The generalization that the disease known as diabetes is merely a symptom of some underlying condition is very valuable. Of course, as we all know, the disease known as diabetes may be caused by some lesion of the nervous system, of the pancreas, of the liver, or, perhaps, of the innermost processes of metabolism. Regarding the disease we call diabetes as a symptom, leads us to search for the underlying cause, and tends toward a more rational treatment.

Further, with reference to the weakness of the heart in diabetes. Of course, we all know the extreme degree of general muscular weakness which exists in that disease, and the heart necessarily participates to some extent in that general weakness; but, beyond this, I have noticed in several cases a very special weakness of the heart due to degeneration of the muscular fibre. I have under observation in Brooklyn a patient, fifty-five years of age, who for four or five years past had a fractional percentage of sugar, one-tenth of one per cent. His health was pretty fair up to the last two months, when, without

warning, he had a severe attack of syncope, which nearly proved fatal. On examination of the chest, I found distinct physical signs of dilatation and degeneration of heart muscle without valvular disease. Under treatment applied simply and solely to the condition of the heart he improved, and has remained well since then, with the exception of a very brief and inconsiderable attack of syncope brought on by over-exertion.

In regard to diet, I can corroborate Dr. Weber's opinion that the very strict so-called diabetic diet is not always of service. I think that is so without question. In my own work, in a number of cases, the strict nitrogenous diet was not well borne, even though it caused the disappearance, partial or complete, of sugar in the urine. The general condition is impaired on the strict diabetic diet. The patient should have a fair variety of food, watching the general condition, and not giving up altogether the carbohydrates and the saccharine substances.

I had much pleasure in listening to Dr. Babcock's paper, because it implies physiological treatment: the use of therapeutic means which are in the line of natural processes rather than the use of drugs, substances which are foreign to the organism. The employment of baths and exercise certainly seems to be gaining ground in a number of diseases. It seems the most natural treatment. His paper also emphasized the importance of very strict attention to detail in apparently unimportant things. If you look into the cases reported, you will find that the effect of the treatment depends on the exact regulation and adjustment of the means used to the varying conditions of the patient. It is largely a matter of judgment and of detail. I, for one, am extremely glad to have heard the paper.

Dr. Quimby: I have long felt that there is a fundamental defect in the present methods of treating organic cardiac disease. We are constantly using the whip to stir up an overworked muscle. Digitalis and most of the so-called cardiac tonics are pure stimulants, furnishing in themselves no additional force. In the use of the nitrites we do attempt something from the other side, in the way of diminishing the vascular resistance; yet, in so doing we interfere directly with general nutrition, for the arterial contraction which follows every retardation of circulation from organic disease is only the physiological reflex that is intended to be compensatory and to restore the normal vascular flow.

It is universally recognized that rest is the one absolute essential for the restoration of an exhausted or failing muscle. In the case of the heart this can at the best be only relative, and however slight must entail a proportionate loss in the circulation. The ideal cardiac tonic is, therefore, mechanical; a force which can be substituted for that of the heart muscle and made to maintain the circulation with a

diminished expenditure of cardiac force. Some unusual results in the treatment of cardiac disease by means of mechanical measures lead me to believe this ideal is in a degree attainable. I can do no more than refer to it at present, as I hope at no distant date to embody my conclusions in full in a paper upon this subject.

Dr. Curtin: I was much interested in the paper of Dr. Weber on the subject of diabetes. I have found during the last three years a number of cases of temporary diabetes. In the hospital last fall the Resident informed me that a case of catarrhal fever came into the hospital with diabetic urine, and in a week the sugar had disappeared and albumin had appeared. He pointed out another case of typhoid fever in which albumin was in the urine when admitted; two weeks later he found sugar. There are a great many cases at the present time of temporary saccharine urine; we can scarcely call it true diabetes. This has given rise to an honest difference of opinion among doctors. A patient is told by one physician that he has diabetes, and later, by another physician, that he has not. These cases are without the serious symptoms spoken of by Dr. Weber, but I thought that the Society might be interested in them.

A year and a half ago two doctors came into my office, one had been examined by the other for life insurance. The doctor had gone to the medical examiner, thinking he was perfectly well, and the examiner found saccharine urine. He asked the examining physician to come with him to me to verify the examination, which he did, and I found a slight trace of sugar. "Now," I said, turning to the examining physician, "in order to determine whether these chemicals are pure, suppose we examine your renal secretion." I found exactly the same condition in this urine. In order to determine further that the chemicals were pure we then examined some of my water, and found no trace of sugar. The doctor who applied for the insurance informs me that at times he finds sugar present and at others absent. Whenever he takes anything in the way of alcoholic drinks, and starchy or saccharine food, the sugar reappears, and with it acute gouty symptoms. The examiner is still well, doing usual professional duty.

A NEW AND DISTINGUISHING SIGN OF LATENT ANEURISM OF THE AORTA.

BY WILLIAM C. GLASGOW, M.D.,
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WE occasionally find in practice cases of aneurism of the aorta where the recognized signs of aneurism are absent, and where a positive diagnosis of the condition will be impossible. In most cases, in the earlier stages there is an absence of dulness on percussion, pulsation, and aneurismal bruit, and it is only later that the recognized signs are apparent. In certain cases the physical signs remain latent for an indefinite period, and it is only through the occurrence of the pressure symptoms that a suspicion of such a condition will arise. Even then there can be no positive diagnosis, as other thoracic tumors may produce the same disturbing symptoms. It will not be necessary, in this association, to dwell upon the importance of such a differential diagnosis and its bearing both upon prognosis and treatment.

In the study of a number of cases of thoracic aneurism I believe that I have recognized a sign which will corroborate the diagnosis, and which will enable us to give a positive opinion in all such cases.

The sign to which I make reference is the presence of a systolic sound, or thud, in the brachial artery, synchronous with the systole of the heart. This sound is sometimes accompanied by an arterial murmur. When this sound can be heard and aortic regurgitation can be excluded, I claim that a positive diagnosis of aneurism can be made, even in the absence of all other signs or symptoms.

I would explain this sign in the following manner:

Under normal conditions the artery is constantly filled with blood, and the walls are subject to a certain amount of tension, the tension being greatest at the acme of the systole of the artery. The blood is being constantly forced onward, first through the propelling force of the heart, and, secondly, through the contractile power of the arterial walls. There is a constant and steady pressure in the blood column, and the artery is constantly filled with blood. If, however, a physical condition should exist which would allow a backward as well as a forward emptying of the artery during the arterial systole, the arterial walls would rapidly collapse, and the artery would be found only partially filled at the time of the succeeding cardiac systole. When the column of blood is forced suddenly, by the ventricular contraction, through the artery with its relaxed walls, the walls of the artery are brought suddenly to a high degree of tension, and the sudden vibration of the walls in this condition produces the sound in the artery. This condition exists whenever there is a leak in the aortic valves and whenever there is a limited dilatation in the aorta, if other conditions are normal.

Scoda, as early as 1869, drew attention to this brachial sound as one of the most significant signs of aortic regurgitation, and I would add that it is equally conclusive of aneurism of the aorta.

In pure aortic regurgitation it is always present. In aortic regurgitation, complicated with other valve lesions or a weakened condition of the heart, it may be absent. In aortic obstruction and regurgitation the aorta is imperfectly filled, also when mitral insufficiency is present, in conjunction with aortic regurgitation, the amount of blood delivered by the left ventricle is insufficient to produce the arterial vibration. This is also true when the left ventricle has become enfeebled from any cause.

The same factors which are necessary to produce it in aortic regurgitation are equally necessary in aneurism. A forcible ventricular contraction, a free and unobstructed flow of blood

through the aorta, are absolutely necessary for its production. In case of dilatation beyond the arch of the aorta I would explain the sign through the syphon action, which would draw the blood from the brachial artery, produced by the flow of blood into the dilated portion of the aorta. The arm must also be extended, to allow the free, unimpeded vibration of the brachial artery.

As the Corrigan, or collapsing, pulse is dependent upon the same physical conditions as those producing the arterial sound, it will be found co-existent with it; the sound, however, is at times evident when the character of this pulse is not well marked, and when its collapsing quality can only be found by the sphygmograph.

In the course of an aneurism we will find the sound disappear whenever the ventricular contraction has been weakened, but it will again reappear if the power of the heart can be strengthened.

I have called this a new sign of aortic aneurism, for I can find no mention of it in the old English, French, or German classics, and modern writers, as far as my reading has gone, do not seem to have observed it.

I report five cases of aneurism in which this arm sign could be heard, and I might have added three more cases, one of subclavian aneurism and two of aortic aneurism; but in those three cases the aneurism existed in conjunction with an aortic regurgitation, and hence would not have been characteristic. In the five cases reported the aortic valves were healthy as far as this can be said through physical examination. In two cases the diagnosis of aneurism was made from this sign alone four months prior to the appearance of the recognized physical signs.

Case I.—J. S., aged fifty-two years, a cattleman, complained in June, 1892, of a catching of the breath and a slight smothering on exertion. He referred his trouble to the upper sternum.

Examination. Heart sounds were normal, percussion sound unchanged over chest. An accentuation of the heart sounds was

heard over the second cartilage, extending to the left. There was harshness of the inspiratory sound in the upper sternal region and inner border of the infra-clavicular region. There was no special pain in the chest. There was no pulsation. The pupils were normal, and the radial pulses equal and free. A systolic sound, like a strong heart sound, was heard in both brachial arteries when the arm was extended and the ear applied to the artery.

The diagnosis of aneurism of the aorta was made. He was given iodide of potash and a certain quietude of life was prescribed.

In November, 1893, the patient again presented himself. He complained of shortness of breath on exertion, with fugitive pains radiating from the sternum through the chest toward the supra-scapular region. On examination, a marked dulness was found over the upper sternum at the second cartilage, the dulness extending to the left; pulsation was evident in the dull area. On auscultation, a marked inspiratory stridor was evident in the upper sternal and left infra-clavicular regions. A loud systolic bruit was heard in these regions, and behind. The heart sounds were normal; the pulse was unequal in the two arms; it was much weaker in the left radial. A systolic sound was heard over the right brachial artery.

On February 24, 1894, patient came again (as he is living in the country he cannot be seen often). The pains in the chest have been very severe, at times. They come and go according to the degree of quietude. After a fatiguing exertion he stated they were almost unbearable. The inspiratory stridor over the upper sternum is very great; this is also heard behind, in the inter-scapular region. The systolic murmur over the upper sternal and left infra-clavicular regions is very loud; this is also heard behind. A marked pulsation exists under the second left cartilage, the space giving a dull percussion sound. The left radial pulse much weaker than the right. A systolic sound in the right brachial artery. The heart sounds are normal.

I have not heard from the patient since that date.

Case II.—Mrs. R. T., aged sixty years. An aneurism of the abdominal aorta; a circumscribed pulsating tumor in upper third of the abdominal aorta, with an upward and lateral expansion; a loud systolic murmur over tumor; a collapsing, or Corrigan pulse; systolic sound in both brachial arteries.

Case III.—C. McC., aged forty-five years, first seen by Dr. Herrman on February 8, 1893. He complained of paroxysmal pain above the heart, extending through to the back. Over the second left interspace a slight pulsation was noticed, and a double murmur heard above the heart. In March, 1894, there is a large bulging tumor the size of an egg at the second left interspace. It pulsates freely with upward and lateral expansion. A systolic murmur is heard, and the percussion sound is dull over the tumor. The aortic sounds are clear and normal. The pulse shows the characteristic collapsing, or Corrigan, pulse. Over the brachial artery a distinct systolic sound is heard.

Case IV.—In April, 1893, J. B., a commercial traveller, aged forty-eight years, called upon me on account of a persistent cough and mild spasms of the glottis, which would occur during the night. A thorough examination of the upper air-passages showed nothing which could cause the cough. Suspecting some pressure on the recurrent laryngeal nerve, by a thoracic growth, an examination of the chest was made. Nothing abnormal could be heard, except the unusual conduction of the two heart sounds to the upper sternal region. The percussion sound was resonant. Normal vesicular breathing was heard everywhere. The heart sounds were normal and clear. In the brachial arteries a systolic sound was heard. The pulse was full and slightly collapsing. The diagnosis of aortic aneurism, with pressure on the recurrent laryngeal nerve, was made.

A week later I was hastily summoned, and found the patient expectorating large mouthfuls of blood. This continued some hours, and a persistent paroxysmal cough came on, which continued day and night. Soon afterward he began to complain of a pain over the middle sternum. He described this as a

dull, heavy feeling, and sought to relieve it by keeping the clothes raised from his chest. He soon began to complain of a lancinating pain extending from the sternum to the back. These pains and the cough continued, with decided intermissions, through the month of May. He obtained a certain amount of relief through the use of the iodide of potash and the free use of phenacetine and salol.

In the latter part of May he was examined by two of the leading physicians of St. Louis—Dr. P. G. Robinson and Dr. H. Tuholske. The only abnormal signs at this time were the signs of a pressure on the left brachus and in the adjacent portion of the lung. The diagnosis made by these physicians was—a thoracic tumor, probably aneurismal. This condition continued during July, and he suffered, with slight intermissions, the most agonizing pains. These would radiate at different times in different directions. In the beginning of August, for the first time, a deep-seated pulsation became apparent over the second rib in the left infra-clavicular space. A systolic murmur developed in the same place; this could also be heard over the left scapular. Over the heart the sounds continued normal. The brachial arterial sound continued through the whole illness, with periods of intermission, when the heart became weak. It, however, returned after the heart had been strengthened by digitalis. It disappeared entirely during the last days of his illness. He died in the first days of September, from exhaustion.

Case V.—P. R. entered the City Hospital complaining of violent attacks of pain over the region of the heart. These occurred most frequently during the night, and would last, unless relieved, for one or two hours. He also complained of a partial loss of voice.

Examination showed a double murmur over the sternum. This was also heard over the left infra-clavicular space and in the left interscapular space. This murmur extended downward toward the heart. Percussion sound was duller over the third cartilage, in a limited area. The left ventricle was not enlarged. The pulse in the left radial and the left carotid was much weaker

than the right. Systolic sound and murmur in the right brachial; it was not heard in the left. A laryngoscopic examination showed a paralysis of the left vocal cord.

DISCUSSION.

Dr. Murray: This case is one of four or five cases in which I have suspected aneurism. My reasons for suspecting aneurism in this case are as follows: The pulses are unequal; there is constant pain on the left side, extending to the shoulder and down the arm to the wrist; on the right side there is an area of dulness, extending from the third rib nearly to the clavicle, and perhaps a little below the third rib; there are no murmurs; the heart, apparently, is not enlarged; the left heart is certainly not enlarged, and I am under the impression that the right heart is not enlarged. I put him down as a case of suspected aneurism, and so I was glad when Dr. Glasgow discovered his characteristic symptom.

Dr. Walker: I should like to thank Dr. Glasgow for the trouble he has had in bringing the case before us. I have listened to these arteries very frequently for murmurs, especially musical murmurs, but I have never looked at them in cases of aneurism.

Dr. Murray: This matter which Dr. Glasgow has brought before us is to me particularly interesting. I have to deal not infrequently with cases of this sort, and if by such a simple means as this I can recognize an aneurism which gives no physical signs, I consider not only myself but the profession at large most fortunate.

As Dr. Curtin has suggested, much harm is often done with digitalis. It is as powerful for harm as for good. In my clinics I invariably insist that if there is a possibility of aneurism the drug shall not be used.

Dr. Babcock: I should like to ask whether a systolic tone in the arteries is not sometimes heard in cases of arterial sclerosis.

I should like to ask the ages of the patients of Dr. Glasgow.

Dr. Glasgow: In reply to Dr. Babcock. 1. The ages of the cases cited were as follows: Fifty-two, forty-eight, forty-five, forty, and sixty years. 2. I cannot answer positively the question as to arterial sclerosis. I do not believe that the arm sign will be found in such cases, as the condition necessary for its production is absent. 3. All these cases, except one, are living to-day.

Dr. Curtin: I have been working in the same direction as Dr. Glasgow, trying to find something which will enable us to discover an aneurism in its earlier stage. Many cases are injured by the early

treatment, by heart tonics, etc. In a majority of instances where a murmur is heard at the base of the heart, without any other manifestation, the case is put upon digitalis or some other cardiac tonic which increases the force of the heart and has a tendency to enlarge the aneurism.

I have been investigating quite extensively upon the effect of pressure. I find you can get, in an average adult, by pressure and forced expiration a contraction of the chest antero-posteriorly of about one and a half inches in many cases, which enables you to touch an aneurism which would be otherwise quite out of reach. Another important point is, I think, the study of the supra-sternal fossa. I have my patients stand in this position—with the elbows together over the forehead—to throw the sternum forward and depress the chin, so as to relax the skin of the neck, and in many cases you can then thrust the finger down behind the breast-bone from three-quarters to one and a quarter inches below the top. Often you can make a positive diagnosis early, by feeling the pulsation of the aneurism against your finger from below in case of aneurism of the arch of the aorta, or if from the right side an aneurism of the innominate will be diagnosticated.

OZONE.

By CHARLES E. QUIMBY, M.D.,
NEW YORK.

Recent medical history affords few more instructive illustrations of unrestrained enthusiasm than may be seen in the effects upon the therapeutics of phthisis of Koch's discovery of the tubercle bacillus, coming as it did at the height of the surgical antiseptic furor. Each man seized the antiseptic nearest at hand and went forth assured that he was to slay the great dragon of tuberculosis. It is more than surprising now, as we recall the story, to see how utterly pathological obstacles and physiological possibilities were overlooked or disregarded, and what superfluous energies were wasted, in proving that which should have been self-evident. Nor is it by any means certain that the present almost universal use of creosote in phthisis is not based largely upon a lingering belief in its germicidal power. Generally, however, the reaction of medical opinion has been so extreme that any expression of a faith in local antisepsis in phthisis is almost sufficient to brand one as a visionary. Before asking your brief attention, then, to some questions relative to the use of ozone, I desire to make my position on this point very clear and definite. Since I first began a systematic study of phthisis I have seen no reasons to justify any expectation, or even hope, that a specific cure for the disease will ever be found, unless it be the product of the defensive action of the living tissues themselves. I have denied the possibility of destroying tubercle bacilli *in situ* by means of any antiseptic at present known. I refer to an article on the use of tuberculin published in January, 1891, and to a

paper read before this Association, to substantiate the claim that my therapeutic efforts have aimed to attack tuberculosis and phthisis essentially through the systemic forces. Upon such a basis abundant reasons have been presented that both justify and demand the use of local pulmonary antiseptics, not in the hope of destroying such bacilli as are contained in living tubercle tissue, but solely against the sources of decomposition and possible centres for fresh tubercle infection situated in the pulmonary air-spaces or on exposed ulcerating surfaces. A year ago my list of local antiseptics had narrowed, by processes of clinical exclusion, to three—alcohol, creosote, and oil of cloves. These were employed constantly in all cases of phthisis, and, apparently, with very satisfactory results. It should be said, however, that no one was ever tested except in connection with other measures, and their specific values are, hence, matters of personal judgment.

When, early in 1893, my attention was called to an apparatus for generating ozone in quantity, knowledge of the properties of that substance led me to undertake a careful clinical investigation of its value as a therapeutic agent. The utter inadequacy of that apparatus to perform the work promised and required is responsible for the meagreness of the data upon which this preliminary report is based. I should feel justified in offering it by way of apology were it not that it has led to a study of ozone apparatus, with results that are equally valuable, although very briefly expressed. I have now arranged an apparatus which will fulfil all requirements, may be used with either battery or dynamo current, supplying small or large amounts of ozone without waste of power, and is comparatively cheap. I shall be pleased to supply any gentleman with drawings illustrating the principles of its construction.

The powerful oxidizing properties of ozone render necessary its consideration from a clinical standpoint under three heads: 1. As a tissue stimulant or irritant; 2. As a local antiseptic; and 3. As a source of systemic oxidation.

1. *As a stimulant or irritant.*

This action of ozone is placed first not only from its im-

portance as a therapeutic measure, but because the possibility of avoiding undue irritant effects is a pre-requisite of its use for any other purpose.

Assuming, as I do, that the direct curative agent in phthisis is the local inflammation, any force capable of modifying this process acquires thereby a definite therapeutic value. The pathology of phthisis demonstrates that in a large proportion of cases the reparative processes are adynamic in character. The direct indication for treatment, in accordance with a well-established law of protoplasmic reaction, is the local application of a so-called stimulant, which means irritant. It is the principle upon which Koch directed the use of tuberculin, and which I have followed from the first in the use of that remedy. In an article bearing upon this subject which I had the honor to present to this Association two years ago reference was made to certain traumatic effects obtained by means of the pneumatic cabinet and their causative relations to increase of nutrition and reparative processes in the lungs.

It is in a similar class of cases, where degenerative or necrotic changes are taking place as the result of defective circulation and diminished tissue activity, a condition directly analogous to that which upon exposed surfaces would indicate the application of an irritant or caustic, that the use of ozone inhalations to the point of distinct irritation has seemed to be of most decided value. This conclusion is based on the general results in all cases where ozone was given in connection with the cabinet, and upon two cases in particular which were treated by ozone inhalations alone. The first of these was a young woman, aged twenty-two years, in the third stage of phthisis, who had been treated for nearly a year by the cabinet alone. Through the winter of 1892–93 she simply held her own. In the late spring she began to gain, and when she left the city in July a large apex cavity was almost entirely dry. During the summer, in the mountains, she had an acute exacerbation of her disease. The cavity filled again and the surrounding infiltration was increased. On her return for cabinet treatment in November she was too weak to bear any

differential pressure, even had I not feared the increased sepsis which might follow any form of treatment other than that for the removal of the septic material. She was, therefore, treated solely by inhalations of ozone, of gradually increasing strength, until they produced a decided sensation of warmth throughout the lung and excited cough. The first treatment was on November 14th. The diminution of expectoration was appreciable within a week, and the increase of strength such that the use of the cabinet was resumed early in December. Although this patient has gradually lost strength during the past winter, there has been no repetition of the acute attack of last summer.

The second case was a young woman, aged twenty-five years, with consolidation at the left apex. The râles were abundant, heavy, and sticky, indicating commencing softening. The sputum was characteristic, thick, tenacious, lumpy, and loaded with bacilli. Treatment consisted of daily inhalations of strongly ozonized air at a rarefaction of from 1.5 to 2 inches of mercury. Results as in previous case. Strength increased, cough diminished, and appetite improved. Within two weeks there was no longer any cough at night, and at the end of a month the patient said she had no cough and felt quite well. This could not have been quite true, as she furnished a satisfactory specimen of sputum for examination. This sputum was much less sticky, and auscultation revealed a proportionate diminution and change of character in the râles. No claim is made that these cases are cured; on the contrary, it is known that they are not. It is simply claimed that the changes noted are such as would be expected from local stimulation, and, therefore, may be attributed properly to the ozone inhalations.

My position on this point may be stated categorically:

a. It is an accepted fact that ozone is a most powerful stimulant to mucous membranes.

b. That it may be so applied by means of the pneumatic cabinet as to manifest this action deeply in the bronchial tubes I have repeatedly demonstrated.

c. If the processes of nutrition and repair in the lung are

subject to the laws governing similar processes elsewhere, then the local application of a stimulant must be of value in all cases of impaired local nutrition with or without ulceration.

d. Ozone, on account of its associated properties, is to be preferred to all substances yet offered for such applications, and its administration is rendered most effective by means of the pneumatic cabinet, through the modifications produced in the pulmonary circulation.

e. The clinical results confirm the accuracy of the foregoing deductions.

Personally, I regard this stimulant action of ozone as one of its most valuable properties.

2. *Ozone as a pulmonary antiseptic.*

It is evident that the irritant properties of ozone place limitations to its availability as an antiseptic, and *à priori* forbid its use in all cases where the pulmonary processes are acutely inflammatory in character. Fortunately, however, from a clinical standpoint, pulmonary antisepsis is seldom so important a factor in such cases as in the class where a mild stimulant or even irritant effect is also desirable.

In looking over the reports for the past few years relative to the therapeutic value of ozone, one is struck by the fact that conclusions drawn from clinical work have been almost universally favorable, while laboratory investigators quite as uniformly deny its value as an antiseptic in any such proportions as will admit of its use by inhalation. It seems possible to reconcile these differences to a large degree if we admit the value of ozone as a stimulant to local tissue activities, which in themselves are strongly antiseptic, and equally possible to believe that under the peculiar conditions of clinical use it may, by reason of its multiple properties, produce results not readily demonstrable by laboratory experiments. I have already expressed my own lack of faith in the power of any available antiseptic to destroy bacilli in living tubercle tissue. The only antiseptic action looked for has, therefore, been sought in the effect of ozone inhalations upon the sputum. Examinations to determine its action upon tubercle bacilli, for which I

am indebted to Dr. Egbert Lefevre, have thus far given negative results, except Case II., referred to above. At the beginning of treatment, and for some time previously, they were reported as abundant. At the end of the month, when the cough and expectoration had so markedly decreased, it required the preparation, at times, of two or three slides before they were detected. It should be stated, in fairness, that all the other cases tested were severe and in the later stages of the disease. The effects of ozone, as thus far demonstrated, upon the tubercle bacilli in the sputum are, therefore, only suggestive and not absolute.

This clinical observation, that the amount of ozone which can be inhaled without undue irritation varies quite directly with the amount and consistence of the sputum, certainly indicates that some of the force of the ozone is spent in modifying the sputum.

In attempting to estimate the influence of ozone upon septic decomposition the temperature has been taken as affording the most accurate index. It is evident that the stimulant effect upon pulmonary circulation, as well as any possible systemic action, will be a factor in modifying the temperature; but as we are looking for clinical results the particular factors in the result are less important. In the cases treated by ozone alone there was a prompt and decided reduction of temperature, notably so in Case II., in which within the month it was reduced from an average afternoon temperature of 101° F. to a fraction over 99° F., as reported by the attending physician.

It is fully recognized that the number of cases observed is, as yet, far too small to permit any specific deductions, more especially as the effect of the cabinet treatment, which was used in conjunction with ozone in all the cases except two, is directly in the line of temperature modification. The only statement which I would make regarding this action of ozone must be an expression of a belief that in these cases the fever reduction was measurably due to the ozone inhalations in all the cases, as well as in the two treated by ozone alone.

3. *Ozone as a source of systemic oxidation.*

Expert testimony as to the possibility of increasing the amount of oxygen in the blood by means of inhalations is somewhat contradictory, laboratory and clinical results again being apparently opposite. Gilman Thompson has stated essentially that increase in the proportion of oxygen in the inspired air is not followed by any appreciable increased absorption; at the same time, he admits the clinical value of oxygen inhalations in certain cases. Caille, on the other hand, states that persistent inhalation of ozone is followed by distinct and reasonably permanent increase of the oxyhæmoglobin.

When it is recalled that in the former case experimentation was with healthy lungs and blood already carrying its full complement of oxygen, while in the latter exactly opposite conditions existed, the results no longer appear contradictory, but together make evident the conditions under which inhalations of oxygen or ozone may be of value. Absorption of oxygen is a vital rather than a simple chemical process, and depends upon both supply and demand, and no increase in the proportion of oxygen in the respired air can make the ratio between the amount required by the system and the amount absorbed greater than unity. It is evident that the established ratio between supply and demand may be modified by changes in either factor.

Given normal respiratory surfaces and the usual proportion of oxygen in the inspired air, any marked increase in the receptive capacity of the blood, as from the administration of iron or from any augmented consumption of oxygen, as in febrile processes, at once lowers this ratio. It must be restored by increased supply, either from more frequent respirations or an increase in the proportion of oxygen in the air. Again, with systemic demand unchanged, any restriction of respiratory capacity, either by diminution of surface or retardation of the blood current, will similarly affect oxygenation through the factor supply. Here, also, the normal respiratory ratio may be restored by increase of the percentage of oxygen inspired, or by restoration of respiratory surface. Now, in phthisis both factors are changed for the bad. The febrile processes

and reparative activities create a greater demand for oxygen, which the diminished respiratory areas and retarded circulation are unable to supply. The conclusion, then, is strictly logical that oxygen or ozone inhalations should be of value not only in phthisis but in febrile conditions as well, and in all cases where there is reduction of the respiratory ratio. Having been convinced that our failures to obtain satisfactory results were due to unreasonable expectations and illogical methods of administration by large and consequently unassimilable doses, my own experiments have been directed to determining the value of an ozonized atmosphere, such as may be produced in any apartment and in which a patient may spend his entire time, when breathed under those modifications of pulmonary circulation obtainable by means of the pneumatic cabinet.

This value was estimated by the effects on the respirations in phthisis and on the assimilation of iron. It may be said generally that in all cases of phthisis the respirations were decreased in number, while in the ozonized air, by varying amounts, determined apparently by the conditions of the respiratory surfaces. When this area was markedly circumscribed by consolidations or bronchial obstructions the decrease amounted to several respirations per minute, which gradually gave place to a sense of easy respiration and refreshment, when, by use of the cabinet, the respiratory areas had been restored sufficiently to bring the average respirations to normal.

One case illustrating this point is so striking as to be worthy of mention. The patient was a man, about twenty-eight years of age, in the last stages of a fibroid phthisis involving both lungs extensively, and with abundant pleuritic fibroses. At the time of examination, after half an hour's rest, his respirations were thirty-eight per minute. At the end of ten minutes' immersion in the ozonized and rarefied air of the cabinet they were twenty-three per minute. This without any cabinet treatment, which was given later. Fifteen minutes after the first combined cabinet and ozone treatment his respirations, while sitting quietly, had risen to twenty-nine per minute.

After five daily treatments, his regular quiet respirations ranged from nineteen to twenty-one per minute. Under these conditions the same ozonized air as at first had but little effect upon the number of respirations. He simply spoke of the air as refreshing. This patient is failing rapidly, yet his respirations, when quiet, do not rise above twenty or twenty-two per minute.

The influence of the combined cabinet and ozone treatment upon the assimilation of iron has been noted carefully in but a single case. A young man, aged thirty-five years, had, about eighteen months previously, received cabinet treatment alone for a few weeks, for the relief of an aortic regurgitation of over seven years' duration. At various times during these seven years he had attempted to take iron, but on each occasion he was soon forced to give it up, on account of severe headaches. His cardiac and arterial conditions were so much relieved by the use of the cabinet that he resumed heavy business cares and discontinued his visits. At that time no attempt was made to renew the use of iron. His present course of treatment began as soon as he was able to leave his room after a severe attack of cardiac irregularity and palpitation that seemed to threaten acute dilatation. While still confined to his room, but as the more urgent symptoms were relieved, he renewed the attempt to take iron, but again was obliged to desist. Shortly after resuming the use of the cabinet, but now with the ozone added, he began taking one three-grain Blaud's pill three times a day. The amount was gradually increased, until, within three weeks, he was taking fifteen grains three times a day. That amount he has now continued some four weeks without the least discomfort or suggestion of headache, although his use of the cabinet has been somewhat irregular of late. The favorable influence of the cabinet treatment upon his general and pulmonary circulation was undoubtedly a factor in this result, yet it seems to me impossible to deny value to the ozone as well. From the foregoing results the following conclusions seem justified :

1. Whenever the systemic demands for oxygen are increased,

such demand may be met by an increase in the proportion of oxygen in the inspired air.

2. Whenever the supply of oxygen is decreased through diminution of the respiratory areas or retarded pulmonary circulation such supply may be restored in a similar manner.

3. Since in any case appropriation of oxygen is a constant process, varying according to the immediate requirements of the system, all therapeutic administration of oxygen should be similarly varied, in amounts sufficient to meet immediate demands and in a form most readily absorbed.

This implies for cases of phthisis an ozonized atmosphere, to be breathed constantly, if possible.

4. Methods of administration should include such measures as will modify favorably the other factors of systemic oxygenation—*i. e.*, the circulation and the respiratory capacity.

While these conditions are fulfilled most completely by the pneumatic cabinet, one cannot spend prolonged periods in that instrument. We are, therefore, to derive the largest value from ozone as a systemic remedy when it is used for purifying and impregnating the air of apartments occupied by patients, by night as well as by day. With the present cheap supply of power this is perfectly feasible, not only in large institutions but in private houses.

In summary, then, we say that ozone is, all in all, our most valuable local pulmonary stimulant; that, as antiseptics go, it is among the best and the most certain to reach the deeper pulmonary spaces; that it is of decided value as a respiratory food; that it is best administered for the first and second purposes by means of the pneumatic cabinet, and for the third by constant inhalation in small proportions.

DISCUSSION.

Dr. von Ruck: The stimulating action of ozone upon the mucous surfaces of the lung we can get from other agents requiring less apparatus and more easily administered; for instance, chlorine gas or

turpentine preparations produce such an effect, which is sometimes desirable.

The long-continued inhalation of ozone in closed apartments I do not think would be a desirable method of procedure, and it will be much better to let the patient inhale pure air, if possible, out of doors, even if but little ozone is present. At Asheville, N. C., I have for more than five years past made observations of the ozone present in the air, and find, thus far, an average of about 50 per cent. of the possible amount. Such an ozonized air is no doubt desirable, and is one of the advantages in the climatic treatment of phthisis; and climatic resorts where ozone is found to be present in appreciable quantities should, other things being equal, have preference over such where none or but little is found. In the meanwhile it will be of interest to know whether the artificially produced ozone and its administration, as proposed by Dr. Quimby, will prove a good substitute for the natural ozone, as we have it upon the Asheville plateau, and, no doubt, in other localities in this country. I believe Dr. Quimby's efforts are in the right direction, for even if the treatment he proposes should be less advantageous than residence in an ozonized mountain air, it will doubtless have some value, and since the great majority of patients cannot go to the climates where ozone is naturally present, anything that we can add to their prospects for improvement at home is a gain and a help which we need.

We measure the relative amount by exposure to the air of specially prepared slips of paper, which are charged with starch and iodide of potash, upon the well-known fact that when such paper is made moist after exposure, and if ozone is present, discoloration, from a slight brownish color to almost black, occurs, the intensity of color depending on the amount of ozone present. If none is present, the paper remains white, and by a graduated color scale, from 0 to 100, we express the relative degree of discoloration, 100 showing the greatest amount ever observed, when the paper turns black.

Dr. Hinsdale: They are purely arbitrary means; we have no definite measure, it is only a relative measure.

Dr. Platt: All knowledge is relative.

Dr. von Ruck: The amount of moisture in the atmosphere is relative, and the amount of ozone in the air is also relative; there are different degrees, and these degrees are conveniently expressed, as we express relative humidity, by percentage.

In observations upon ozone made by me in Ohio I have never been able to find more than 5 per cent., while in Asheville we frequently have 75 and occasionally 90 and 100 per cent., and this percentage seems to me just as valuable as though we expressed it by grains or cubic inches. As a therapeutic agent, it is yet to be proven that unusually large quantities artificially produced are as good or better

than that furnished by Nature in certain localities where its influence is continuous.

Dr. Quimby: If we accept Dr. von Ruck's standard, the percentage produced by the ozone machine must be something like 20,000. There are, of course, methods of measuring the volume percentage of ozone, and the statement that the air of any locality contains 100 or even 50 per cent. of ozone is obviously unscientific, and would be misleading were it not that its impossibility as a scientific fact makes it evident that the estimate was made upon some arbitrary standard. Dr. von Ruck's criticism of ozone as a local stimulant and irritant, because other substances are also irritant, has no force, for everyone understands that stimulants or irritants are selected quite as much from what they do not do as what they do do. Ozone is our best pulmonary local stimulant, because all its associated actions are valuable.

I cannot admit that any amount of deep breathing would have reduced the respirations as in the case cited; but even admitting that it would, the fact is not pertinent to the point at issue, nor could it detract from the results given as proof of the power of ozonized air to increase the absorption of oxygen for systemic use. The patient was breathing quietly, his respiratory areas were not increased, and only an increased absorption of oxygen can account for the change in respirations. I am glad to express my appreciation of the purity of the air at Dr. von Ruck's place of residence. At the same time, I am unable to appreciate what relation it has to the value of ozone inhalations under other circumstances. My argument as to the value of an excess of ozone in the respired air, such as can be had only by artificial means, under certain conditions and for certain purposes, appears to me to be unaffected by any statements regarding the nature of some other form of ozone.

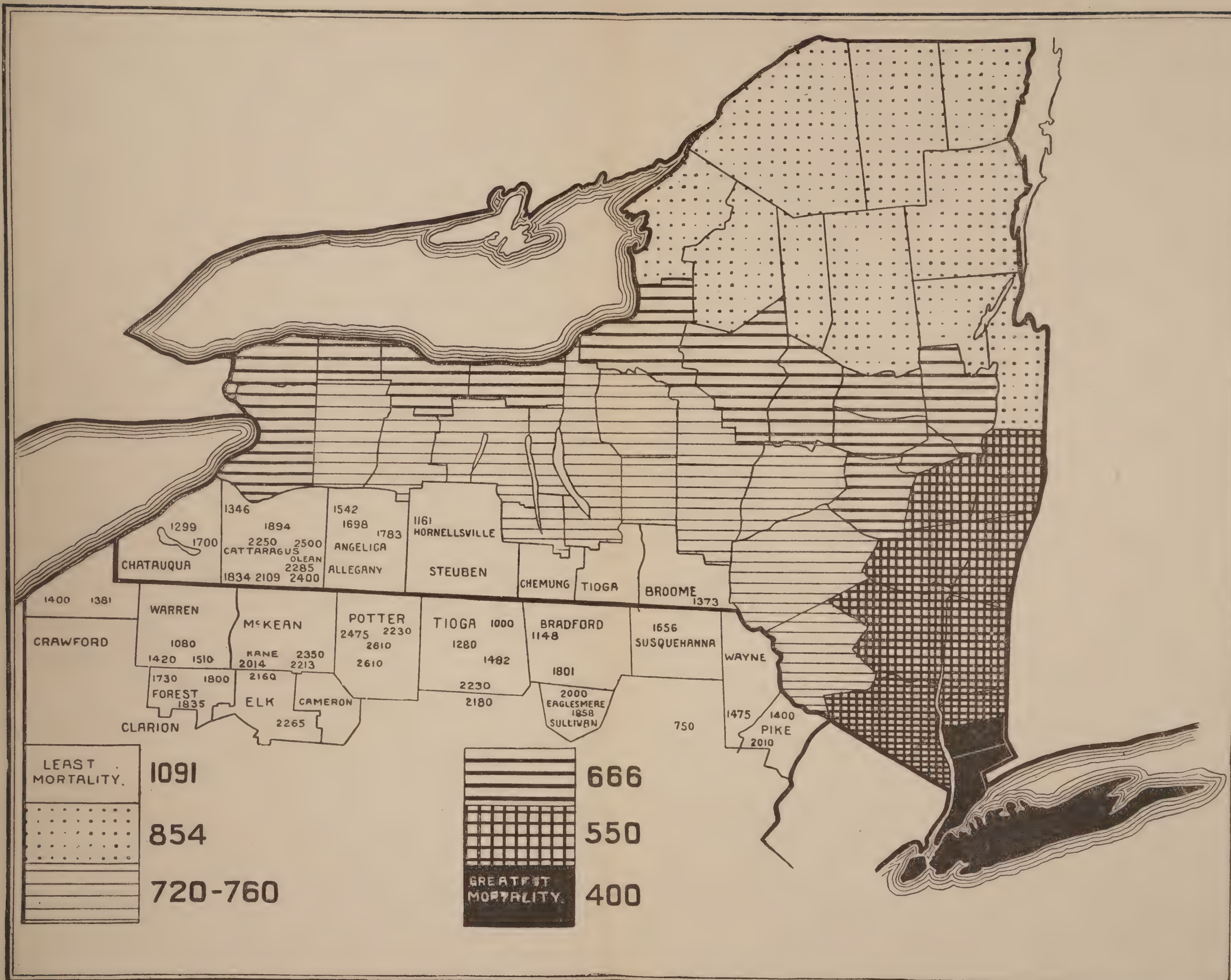
THE COMPARATIVE RARITY OF PULMONARY TUBERCULOSIS IN THE HIGHLANDS OF PENNSYLVANIA AND THE ADJACENT COUNTIES OF NEW YORK.

By GUY HINSDALE, M.D.,

PHILADELPHIA.

If the profession were asked what district in the New England or Middle States showed the greatest immunity from pulmonary tuberculosis, the answer would probably be "The Adirondack Mountains." Without, however, disparaging that great health-resort, where such remarkable opportunities for pleasure and recuperation are afforded to the tens of thousands that flock there—a resort to which I am personally deeply attached—I would, nevertheless, call attention to a region much nearer the homes of many of us; in most respects more suitable for continuous residence, and apparently even more healthful than the Adirondack region itself.

The district referred to falls partly within the State of New York and partly within Pennsylvania. The seven counties along the southern border of New York are Chautauqua, Cattaraugus, Allegany, Steuben, Chemung, Tioga, and Broome. The neighboring region in northern Pennsylvania includes the counties of McKean, Potter, Forest, Clarion, Elk, Cameron, Union, and Sullivan, and, at some distance to the eastward, Pike County. In all of this region, comprising over 12,000 square miles, nearly equally divided between New York and Pennsylvania (6545 miles in New York, 5557 in Pennsylvania), there is, according to the best available in-



Map Showing the Distribution of Pulmonary Tuberculosis in the State of New York and Adjacent Counties of Pennsylvania.

The small numerals in the map indicate the altitude; the large figures below, the average number of persons living to each annual death from pulmonary tuberculosis.

formation, a population of over 1000 persons to each annual death from pulmonary tuberculosis. I confess I was somewhat surprised to discover that in New York State the southern tier of counties from Broome westward make the best returns.

Taking the reports of the State Board of Health for 1893, I find that in the maritime district, including New York, Westchester County, and Long Island, there are 400 persons living for every annual death from pulmonary tuberculosis; in the Hudson River district, 550. Next in order comes the Mohawk Valley; then the Lake Ontario and western region; next the central counties; then the Adirondack and northern district, in which there are from 854 to 985 persons living to one death from pulmonary tuberculosis; and finally and best of all, in New York the seven counties of the southern tier, with 1091 persons living to each death from pulmonary tuberculosis. The accompanying map shows this relative prevalence of pulmonary tuberculosis in the State of New York.

During each of the last four years the mortality from pulmonary tuberculosis in the southern tier of counties in New York, in comparison with the total deaths, is far below what obtains in other portions of the State. This is clearly illustrated by the annexed chart. It is evident that from whatever standpoint we look at the subject the southern tier of counties are the freest from pulmonary tuberculosis.

Among the characteristics of this region are the following:

Population. Sixty-two persons per square mile; engaged chiefly in agriculture.

Soil. Highly productive. Geologic formation, limestone and sandstone.

Products Hay, oats, potatoes, grapes, standing timber.

Temperature. The mean annual temperature in 1892 was 44.5°, or six and one-half degrees less than in New York City, and three and one-half degrees more than in the Adirondack region. The latest killing frost occurred on April 26th at Jamestown, and the first frost November 5th; this was about the same as in New York, and gave an agricultural

season twenty-four days longer than in the Adirondack region.[1]

Rainfall. This varies from 37 to 47 inches annually in the southern tier. The amount is usually less than in other portions of the State.

Elevation. In the southern tier of counties the following elevations are noted:

Alfred Centre, 1820 feet; Angelica, 1340 feet; Friendship, 1550 feet; Binghamton, 860 feet; Nineveh, 1032 feet; Humphrey, 1500 feet; Sherman, 1568 feet; Elmira, 863 feet; Savona, 1053 feet.

It will be noted that these elevations are somewhat below those of the stations in the adjacent district in Pennsylvania, to be considered later.

Position with reference to storm-tracks. The region considered is the farthest removed in New York State from the path of greatest frequency of storms. These are prone to pass down the valley of the St. Lawrence. This southern region is thus spared some of the cloud and rain accompanying the moving areas of lowest barometric pressure.

Accessibility and accommodations. All points in this region are reached by the New York, Lake Erie and Western Railroad, and desirable accommodations may be found about Chautauqua Lake and Jamestown.

No special claim has been made for this region with reference to the climatic treatment of pulmonary tuberculosis; but in Chautauqua, Cattaraugus, Allegany, and Steuben counties a new and uncontaminated field is opened for the treatment of tuberculous patients, with many opportunities for self-support not found elsewhere.

The Highlands of Pennsylvania adjacent to the New York border are of a somewhat different physical character. The country is wilder, the forests more extensive, the general ele-

[1] The stations in the southern tier district reckoned were Jamestown, 47°; Alfred Centre, 43°; Angelica, 43°; South Canisteo, 43°; Addison, 45°; Hammondsport, 43°; Binghamton, 54°; Humphrey, 50°.

In the Adirondack district the stations are Lyon Mountain, 39.2°; Malone, 41°; "Number Four," 40°; and stations in Essex and St. Lawrence counties, 42°.

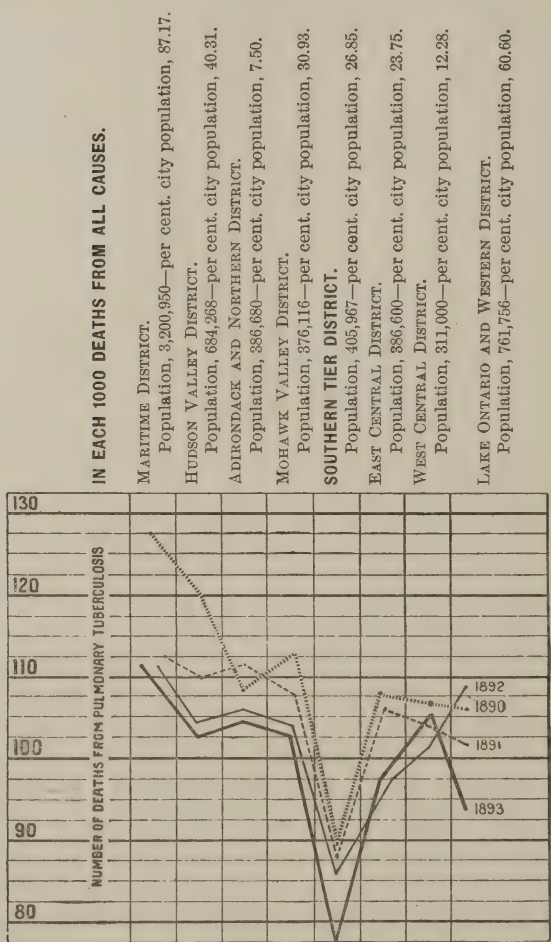
vation greater; it is a little cooler, a little drier, a little more primitive. Agriculture is not nearly so remunerative; the industries are more prominently lumbering and mining for coal, iron, and oil. Vast areas of hemlock, and here and there growths of pine cover the mountain-tops, while there are many ridges timbered with beech, birch, and maple. The climate is superb during the months of May, June, July, August, and September; it is distinctly bracing, with the sunshine of more southern latitudes. Cold weather usually sets in about November 1st, and continues in what is called a "solid winter" until the following April. For nearly four months there is usually good sleighing. A temperature of zero is not felt to the same degree as the freezing-point in most places where there is fog, where the air is less dry and bracing, and where the rainfall is greater and the soil more retentive of moisture. Pleurisy and pneumonia are uncommon, and epidemics of diphtheria and scarlet fever are said never to occur. A physician in McKean County writes me: "I have seen but three cases of true diphtheria during my fifteen years' residence here. I have never known a case of pulmonary tuberculosis to originate here, and the cases that come here are greatly benefited or entirely cured."

The broad and high table-land in northwestern Pennsylvania has great topographic advantages over the surrounding region, in that its surface is not so deeply cut by water-courses. The counties of McKean, Forest, Elk, and Clarion comprise the highest ground; the streams take their rise from this "Big Level," as it is called; they are still small and have not produced the deep gullies and narrow valleys which are a common feature throughout northern Pennsylvania.

In the outlying region the chief settlements are necessarily found along these water-courses, while the uninhabited mountain-tops, far above the foggy and fertile valleys, are rarely visited except by lumbermen.

In Sullivan County deep indentations penetrate its entire area; nevertheless, we find on one of the mountain-tops two beautiful lakes, about which are clustered the summer homes

of many who have discovered the great benefit to be derived from a residence in this attractive region.[1] The tableland



of McKean, Forest, Elk, and Clarion counties is not so diversified, therefore the scenery is not so striking. On the other

[1] Eagle's Mere and Highland Lake; elevation 2060 feet.

hand, the county has certain advantages. The timber is of more primitive growth and covers a greater extent; the air is drier and pulmonary tuberculosis is found to be less prevalent. McKean County carries off the palm in this respect. The last and only trustworthy data on this point were afforded in 1880, when it was found that 1330 persons were living to each death from pulmonary tuberculosis during the year. This was a much smaller mortality than obtains in the southern counties of New York (1091 living to each death from pulmonary tuberculosis), and less than one-fourth of that which is annually recorded in New York City and Philadelphia.

The great desideratum in the climatic treatment of pulmonary tuberculosis is a region unfrequented by tuberculous subjects; a country that affords, at moderate elevation, a stimulating climate, a dry and therefore a permeable soil, an evergreen forest, a clear sky, and ample opportunities for out-of-door life. The Highlands of Pennsylvania, and especially McKean County, provide all of these features. Kane, in the southwestern corner of McKean County, has already acquired some reputation as a desirable summer-resort. Personal testimony from patients who have gone there has been exceedingly gratifying, and I have no hesitation in recommending a residence in this locality for all cases of pulmonary tuberculosis in at least the first and second stages.

In order to be utilized to the greatest advantage the patient should reach his destination in the late spring or early summer. He should become acclimated during the milder portion of the year, when the new surroundings make the most favorable impression upon his mind; when in his walks and drives, and in his intercourse with the resident population, he is able to form those attachments to persons and things that go so far to incline him to stay beyond the period when most summer visitors are compelled to leave. The fine autumn days in northern Pennsylvania may be to him the most enjoyable and profitable season; the winter, with its abundant snow, unbroken by changes of temperature so common at the seaboard, will be

well adapted, under intelligent supervision, for his open-air treatment.

There is no question in my mind that all the good that has been accomplished at the Adirondack Cottage Sanitarium might be repeated in Pennsylvania, and many lives be saved to the Commonwealth. A good hotel, easy walks and pleasant drives, and a convenient railroad constitute the present accommodations ; but I hope that the time will come when either the State, in its generous provisions for charitable institutions, or else private philanthropy, which seems never to tire of establishing new hospitals in cities, will turn a pitying eye on the consumptive so that he may have the purest air under heaven and the same skilful and sympathetic treatment that are so generously given to others.

DISCUSSION.

Dr. Otis: We should bear in mind in considering the matter of immunity in phthisis two elements: One is the sparseness of population; the other is their occupation. I wish Dr. Hinsdale had given a map showing the population in various parts of this region. Of course, the sparser the population and the more out-door the life, the fewer the cases of phthisis. It may be if the portion Dr. Hinsdale has indicated as more unfavorable was as thinly settled and the occupations the same, there would be less difference in the number of cases. I think that is a point which we should always consider, and is often lost sight of. In many of the most favorable climatic resorts the plea has been made that there are so few deaths from phthisis in proportion to the inhabitants, whereas it is forgotten that they are sparsely settled regions and the native inhabitants an out-door people.

Dr. Hinsdale : I have simply written the paper to point out the fact that discoveries of suitable resorts may be made in that district. I know well that the reports from cities in that region, such as Binghamtom and Elmira, are unfavorable, and I have no desire to claim for them any special freedom from phthisis ; but the rural districts, especially nearest to the Pennsylvania line, are the ones to which I have particularly called attention.

Dr. Fisk : I give Dr. Hinsdale perhaps the first fruits of his article. Immediately on my return home I shall have to decide with reference to the return of a patient who has been under my care for the past

winter, who is very desirous of returning to her home in Johnstown for the summer months. I have been holding the matter in abeyance, but Dr. Hinsdale's paper will determine me to let her try it.

Dr. Walker: I was much interested in Dr. Hinsdale's paper because it gives us data, which can later be corrected, somewhat as Dr. Otis has suggested. It is data of decided importance. Unquestionably we cannot send all our patients to the most desirable climates of the far West, where the high plateaus have advantages not to be secured near the seaboard. It is this large number of phthisical patients which calls for attention. Dr. Pepper read a paper before this Association, probably eight years ago, similar to this. I think Dr. Hinsdale had a large hand in the formation of that paper, and that probably led to his work in this direction; that did not particularize localities so thoroughly as the present paper.

In regard to the number of persons living in proportion to the deaths, many things will modify that. There is one area in Philadelphia, where Dr. Hinsdale and Dr. Curtin practise, where the mortality is largest; it is an area of some five acres, where there are more deaths than in any other district of the city. It is the Philadelphia Hospital. It would not be fair to say that this was a more unhealthy locality. It is because it is a large hospital. This region described by Dr. Hinsdale is not extensively known as a region of value to phthisical patients; but numbers of patients go to the Adirondack region, so that the population of the Adirondacks is a transient one, made up of people who are in search of recreation and sport, and a larger number who are in search of health. I have no doubt the number of deaths in the Adirondacks is made up largely from visitors. On that account figures relating to the mortality as regards the population would be somewhat misleading.

I thank Dr. Hinsdale for the results of an immense amount of work which is represented by this paper.

SOME METEOROLOGICAL DATA.

By SAMUEL A. FISK, A.M., M.D.,
DENVER, COL.

At the last annual meeting of this Association a committee, of which I am one, was appointed to collect meteorological data of the resorts in this country and report to this body. With a view to carrying out the wishes of the Association, in regard to the Colorado climate at least, I have had compiled from the statistics of the United States Weather Bureau a series of tables which will, I trust, convey some information, both by means of comparison and directly, with reference to the nature of the Colorado climate. I have selected eighteen stations scattered all over the United States, chosen with the object of their illustrating the climate of some of our larger centres, and of our resorts as well, and aiming to illustrate further the climatic conditions of the various portions of our country.

Augusta, Georgia, in these tables, has been chosen because of its being the nearest signal station to Aiken, South Carolina, which is, I believe, a distance of some fifteen miles or so. Fort Grant, Arizona, has been chosen to illustrate the climate of that region in the main table, because the signal station was there until its removal, a year or two ago, to Tucson. While I shall use the tables mainly to illustrate the Colorado climate, they, nevertheless, will serve to demonstrate very well the climates of the several portions of our country, and being compiled as they are from United States Weather Bureau statistics and by an officer in their employ, they are worthy of the highest credence.

TABLE I.—METEOROLOGICAL DATA FOR TEN YEARS, COMPILED AT THE DENVER WEATHER BUREAU OFFICE.

Stations.	Elevation.	Mean actual pressure.	Mean relative humidity.	Mean absolute humidity (grs. vapor).	Mean precipitation.	Mean temperature.	Prevailing wind, direction.	Average daily wind, velocity.	Number of days.		
									Clear.	Partly cloudy.	Cloudy.
Augusta . . .	196	29.923	74	4.54	45.26	64	N.E.	92	132	134	99
Boston . . .	126	29.885	72	2.76	41.19	48	W.	270	118	143	94
Chicago . . .	824	29.270	73	2.66	35.10	48	S.W.	254	108	143	114
Denver . . .	5287	24.744	52	1.89	15.33	49	S.	169	150	164	51
El Paso . . .	3796	26.245	44	2,38	8.60	63	N.W.	140	217	115	33
Ft. Grant, Ariz.	4812	26.226	43	2.38	16.66	60	N.	163	207	113	45
Jacksonville .	43	30.050	78	5.76	53.96	69	N.E.	149	119	152	94
Los Angeles . .	330	29.634	72	4.23	19.54	62	W.	119	178	139	48
New York . .	185	29.865	73	3.08	46.83	52	N.W.	231	107	156	102
Olympia . . .	44	29.994	81	3.31	46 80	50	S.	79	102	111	152
Philadelphia .	117	29.948	71	3.19	40.45	54	N.W.	232	113	139	113
Portland, Ore. .	118	29.955	76	3 31	44.11	53	N.W.	123	110	118	137
Salt Lake City .	4346	25.643	54	2.21	16.00	52	N.W.	121	153	130	82
San Antonio .	722	29.258	68	4.86	30.46	68	S.E.	175	114	148	103
San Diego . ,	93	29.919	76	4.38	12 28	61	W.	132	162	138	65
Santa Fé . . .	7042	23.293	48	1.67	12.97	49	N.E.	165	186	133	46
St. Paul . . .	850	29.116	74	2 29	24.72	43	N.W.	166	95	165	105
Washington .	112	29.963	72	3.31	48.22	54	N.W.	138	118	142	105

NOTE —Fort Grant, barometer means for nine years only; San Antonio, means for 1885 for ten months only; Santa Fé, all means for nine years only.

ELEVATION. A glance at the columns giving the elevations shows that Denver is a fair example of a high altitude resort, so far, at least, as its climatic conditions are concerned. Situated as it is just one mile above sea level, it must necessarily have a lighter barometric pressure and those accompaniments of climate that are coincident with high elevations. So far as altitude is concerned, it will be seen that Denver is about 1800 feet lower than Santa Fé, that it is about 1500 feet higher than El Paso, and some 2800 feet above Tucson. It must, therefore, fairly stand as a type of a high altitude resort; and by "Denver" I mean that portion of the eastern slope of the Rocky Mountains contained within the State of Colorado.

DRYNESS OF THE AIR. In addition to the element of altitude must be added that of dryness of its air. This is very well shown by the columns of the mean relative humidity and the mean absolute humidity in grains of vapor, which means, together with others given in Table I., are the means of ten years

of observations. In these columns it will be seen that both as regards the relative and absolute humidity of its air Denver stands in the forefront. While in its relative humidity it does not rank quite so high as El Paso, Fort Grant, or Santa Fé, it is, in common with them, greatly drier than the other resorts, including San Antonio and San Diego, and immensely drier than the centres from which most of our phthisical patients come.

A glance at the table of absolute humidity, by which I mean the actual number of grains of vapor contained in a cubic foot of air, will show that Denver is outranked only by Santa Fé, and should not be mentioned in the same class with Jacksonville, Augusta, Los Angeles, San Antonio, or San Diego, which have moist climates.

Precipitation. So far we have two prominent characteristics illustrated by this table, namely, elevation and atmospheric dryness. To these must be added a small amount of precipitation, by which I mean rain and snow. The mean for ten years gives Denver but 15.33 inches, which is about a third of that in Augusta; some $32\frac{1}{2}$ inches less than the rainfall and snowfall of Jacksonville, Florida; half that of San Antonio, and greatly under the rainfalls of the larger cities of the East, though it is somewhat in excess of the rainfall and snowfall of El Paso, San Diego, and Santa Fé. We must, therefore, add this peculiarity of a small amount of rainfall and snowfall to the other climatic conditions of elevation and dryness as factors to be regarded as favorable to the cure of the phthisical condition.

Temperature. When we come to the question of the mean temperature, the table shows that Denver must be classed amongst the cool climates. The mean for St. Paul shows an average of 6° lower temperature than Denver, while Denver ranks 14° below El Paso, 11° lower than Fort Grant, 20° lower than Jacksonville, 15° lower than Augusta, 13° lower than Los Angeles, 19° lower than San Antonio, 12° lower than San Diego, and exactly the same as Santa Fé and about that of Boston and New York. To the qualities of elevation,

atmospheric dryness, and small amount of precipitation must be added that of a cool climate.

WINDS. The table shows that the prevailing direction of the wind is from the south, which is a particularly mild wind, coming as it does over a long stretch of dry land with the nearest water of any consequence, the Gulf of Mexico, some 900 miles away.

The table showing the average daily velocity of the wind will probably be a surprise to most readers, as Colorado, somewhat unjustly, has acquired the reputation of being subject to frequent and disagreeable winds. This table, it must be borne in mind, gives an average for ten years and it is to be relied upon, because if there is any one department in the weather service in which observations have been accurately recorded it is this one of wind velocity. This table shows that the average daily velocity in Denver is considerably greater than that of Augusta and Olympia; that it is somewhat in excess of the daily velocity in Portland, Salt Lake City, Utah, Los Angeles, San Diego, El Paso, and Washington; that it ranks along with St. Paul, Santa Fé, and Fort Grant; that it is under San Antonio; that it is greatly under Philadelphia and New York; that the daily average is 85 miles less than that of Chicago, and 101 miles less than that of Boston. From this it will be clearly seen that Denver is in no way—and by "Denver" I mean the country for which it stands—entitled to the epithet "windy," and that, on the contrary, the daily motion of the wind is much less than prevails in our large cities from which most of our patients come. This point I hope to illustrate further on. We may, then, add to the other characteristics of elevation, dryness, small amount of precipitation, cool climate, and prevailing mild wind that of only a moderate daily motion of the wind.

CLEAR DAYS. We next come to a consideration of the number of clear, fair, and cloudy days in a year, and here, again, it must be borne in mind that the table is a mean for ten years, and so can be considered to give a fair average. By the term "clear," in this connection, is meant a sky that is abso-

lutely free from clouds, or only three-tenths clouded. A fair sky is one that is from four-tenths to seven-tenths clouded. A cloudy sky is one that is from eight-tenths to ten-tenths obscured by clouds. These statistics are based on frequent observations from sunrise to sunset. The figures show that El Paso and Fort Grant greatly outnumber Denver in the number of clear days, averaging, the one 67 and the other 57, more absolutely clear days in a year than Denver. Los Angeles shows a preponderance over Denver of 28 absolutely clear days, San Diego of 12, and Santa Fé of 36. Salt Lake City is only 3 days in excess of Denver, Augusta 18 days less, Jacksonville 31, San Antonio 36, and St. Paul 55 less. As compared with Boston and Washington, Denver has an excess of 32 clear days. She has 43 more clear days than New York and 42 more than Chicago. Perhaps the point will be more clearly illustrated by considering the absolutely cloudy days, for these are the days on which it is not possible for the invalid to go out at all. Here we find a preponderance in favor of El Paso of 18 days and of Fort Grant 6 days, Los Angeles 3 days and Santa Fé 5 days in a year; but as compared with Jacksonville and Augusta, Denver leads by 43 and 48 days. She has only half the number of cloudy days that New York, Chicago, St. Paul, and Washington are blessed with, and 62 less absolutely cloudy days than hang over Philadelphia. We may, then, add this element of an open sky as a climatic condition favorable to the phthisical invalid to those other favorable conditions which we have seen to exist in Denver, namely, elevation, atmospheric dryness, a small annual precipitation, a cool climate, a mild prevailing wind of only moderate velocity.

By Seasons. The study of the main table has given us some positive ideas about the nature of the Colorado climate, both regarded by itself and as seen by comparison with other climates. It would be of great value to study it more closely with reference to the seasons, and to see how far the general conclusions are borne out when applied to the seasons, more especially the spring, autumn, and winter months, when an invalid should be away from his home. With this in view, I

have had additional tables compiled for the year 1892, the most recent year with regard to which the data are published; and I shall also introduce other tables that I have previously published in other articles to help illustrate the subject.

Seasonal Dryness. The elevation, of course, is a constant factor. The barometric variation is so nearly constant as to cut but a small figure in the main question. We will now look to a consideration of the seasonal relative and absolute humidity.

Table II.—Seasonal Meteorological Data, 1892.

Stations.	Relative humidity.					Absolute humidity.				
	Winter.	Spring.	Summer.	Autumn.	Average.	Winter.	Spring.	Summer.	Autumn.	Average.
Augusta	76	67	79	75	75	2.56	3.95	7.74	4.38	4.38
Boston	73	61	71	73	74	1.36	2.05	5.76	3.08	2.66
Chicago	83	75	76	71	76	1.30	2.38	5.76	2.86	2.66
Denver	60	54	45	45	51	0.96	1.48	3.08	1.74	1.67
El Paso	47	33	32	39	36	1.48	0.92	2.76	2.05	1.67
Jacksonville	78	70	82	82	78	3.68	4.86	8.25	5.95	5.38
Los Angeles	71	75	74	71	72	3.08	3.68	4.86	3.95	3.81
New York	74	69	74	70	73	1.54	2.47	6.36	3.19	2.97
Olympia	90	77	70	84	80	2.56	2.97	3.95	3.68	3.19
Philadelphia	72	66	71	71	70	1.54	2.47	6.58	3.31	3.08
Portland, Ore.	86	74	64	84	77	2.47	3.08	3.95	3.81	3.31
Salt Lake City	79	61	38	47	56	1.48	2.38	2.97	2.05	2.13
San Antonio	62	57	64	63	61	2.66	4.23	7.02	4.70	4.38
San Diego	73	77	78	74	76	3.43	4.09	5.20	4.54	4.38
Santa Fé	59	40	33	40	43	1.04	1.19	1.97	1.48	1.42
St. Paul	79	72	71	71	73	0.84	1.97	5.20	2.56	2.29
Tucson	57	39	31	36	41	1.97	1.97	3.31	2.47	2.47
Washington	74	68	75	71	72	1.54	2.76	7.02	3.31	3.19

Note.—Elevation of Tucson, Arizona, 2432 feet.

By comparison we see that the average relative humidity and the average absolute humidity for the year 1892 is about the same as the mean obtained in our first table, which shows that the year 1892 was a fair one to select with regard to these two points. Our table shows that, while there was a slight increase in the relative humidity for the winter months, there was an absolute diminution. The spring and autumn months were approximated to the average. A closer study of the table shows that Denver maintains about the same position, seasonally, with reference to the other stations under consideration that she did

when taking the range of ten years. It is not worth while to go over this ground again. The tables on this and other points are worthy of careful investigation, but a detailed accounting would be tedious.

TABLE III.—SEASONAL METEOROLOGICAL DATA, 1892.

Stations.	Total precipitation.					Number of cloudy days.				
	Winter.	Spring.	Summer.	Autumn.	For year.	Winter.	Spring.	Summer.	Autumn.	For year.
Augusta	11.93	8.84	11.42	7.08	39 27	38	21	24	15	98
Boston	7.89	9.99	10.48	8.66	37.02	33	27	26	28	114
Chicago	5.19	11.15	14.66	5.56	36 56	42	39	27	25	133
Denver	2.47	5.09	3.10	4.36	15 02	16	24	11	8	59
El Paso	2.43	0.41	1.21	1.27	5.32	9	4	3	8	24
Jacksonville	7.28	2.21	14.38	18.02	41.89	37	23	41	37	138
Los Angeles	8.25	5.67	2.07	4.73	18.72	26	20	1	11	58
New York	8.52	11.28	9.32	9.78	38.90	43	28	21	21	113
Olympia	17.00	10.20	2.73	19.48	49.41	54	50	31	39	174
Philadelphia	7.55	11.47	7.69	8.07	34.78	41	38	29	19	127
Portland, Ore.	13.96	9.21	2.28	8.13	33.58	47	28	18	34	127
Salt Lake City	4.64	5.76	1.26	2.42	14.08	45	41	7	15	108
San Antonio	6.38	2.80	12.96	3.66	25.81	29	17	12	15	73
San Diego	5.23	2 52	0.18	1.16	9.09	26	23	12	16	77
Santa Fé	3.26	2.70	3.98	1.68	11.62	7	9	3	10	29
St. Paul	1.99	6.89	20.20	3.47	32.55	32	41	24	24	121
Tucson	4.40	1.33	3.24	0.64	9.61	22	14	20	9	65
Washington	12.30	14.29	8.48	7.27	42.34	39	31	12	22	104

SEASONAL PRECIPITATION. It is of great importance to determine the amount of precipitation, rainfall and snowfall, seasonally, as it, together with temperature and sunshine, determines largely the patient's ability to lead an out-of-door life. The earlier consideration showed us the very small amount of rainfall and snowfall, on the average, to which Denver is subjected. Here, again, the comparison with the main table indicates that the year 1892 was an average year. Looking over the column for the winter months, it is interesting to note that Denver's total precipitation of 2.47 inches is virtually the same as that of El Paso, about $\frac{1}{2}$ inch in excess of that of St. Paul, about 6 inches less than that of New York, 5.4 inches less than Boston, 6.8 inches less than that of Los Angeles, and about 10 inches less than that of Washington. The spring and autumn months have a larger amount of precipitation, but even here we find it much less than that of any of the centres

from which our invalid population comes. It must further be borne in mind that the character of the soil along the eastern slope of the Rocky Mountains is sandy and porous, and that any moisture that falls is rapidly absorbed, so that virtually the invalid is not incommoded to any extent by the question of snowfall and rainfall.

SEASONAL TEMPERATURE. The question of temperature should be studied carefully, for in this respect, as well as with reference to the character and velocity of our winds, there has been a widespread misunderstanding. It is a well-understood fact that elevation, coupled with dryness, is a factor favorable to diathermancy, and it is to be expected that that condition would exist in Denver. Our climate has been severely criticised for its extremes of temperature, and I myself will acknowledge to having seen a variation in twenty-four hours of 80°. I have seen—though rarely—a registration at night, in midwinter, of 18° below zero, and at noon the next day of 62°. It behooves us, therefore, to investigate somewhat more closely with reference to the question of temperature, if we desire to obtain a fair understanding of the subject. It should go without saying, that the temperatures that concern the invalid are those of the hours of sunshine, for these are the hours in which he is out-of-doors, and the remainder of the day he should be in-doors, where he can easily regulate the temperature to suit his individual case. So then we may fairly, it seems to me, eliminate the night temperatures, and see how it is with reference to the temperatures by day.

TABLE IV.—DENVER, COL., MEAN TEMPERATURE, 1884–85.

Months.	9.08 A.M.	1.08 P.M.	5.08 P.M.
September	67.4°	75.4°	74.6°
October	56.2	61.1	64.1
November	41.6	53.3	49.9
December	25.6	32.5	26.8
January	27.0	35.8	33.3
February	31.9	38.0	37.8
March	41.3	48.2	47.7
April	47.7	53.9	54.3

In the years 1884 and 1885 the local observer took observations at 9.08 A.M., 1.08 and 5.08 P.M., and I introduce a table (IV.) giving the means of these several observations for the eight months from September to April, inclusive. The table shows conclusively that Denver, when regarded seasonally, must come under the head of a cool climate. If we take the 1 o'clock observation, however, as a fair representative of the temperature for the invalid, we will see that at no time is it so low as to preclude living out-of-doors. The temperatures given here are air temperatures, and are the readings of the thermometer placed in a shelter-box on the top of one of our highest buildings; the registrations are, therefore, likely to be somewhat lower than the temperature closer to the ground, and are very different from the temperature that one feels when exposed directly to the sun's rays. This question of diathermancy plays a very important rôle in this respect. One has simply to experience to know the great difference between the temperature of the sun and that of the shade in Colorado. So marked is this that one intuitively seeks the shady side of the street in summer and the sunny side in winter. Table V. illustrates this point very clearly. The solar temperature was taken by a blackened-bulb thermometer *in vacuo* and exposed to the direct rays of the sun. The table shows the solar temperature, the air temperature, and the difference between the two at the 1 o'clock observation for the year 1886. One is appalled at reading the differences, ranging from 54.7° to 67°. For instance, with a solar radiation of 92.5° at 1 o'clock in January we find an air temperature of 27.3°, or a difference in temperatures of 65.2°. In July we find an average solar radiation at 1 o'clock of 146.5° and an average air temperature of 85.2°, or an actual difference of 61.3°, and in November a solar radiation of 100° and an air temperature of 41.3°, or an actual difference of 58.7°.

TABLE V.—DENVER, COL., MEAN TEMPERATURE, 1 P.M.

1886.	Solar.	Air.	Difference.
January	92.5°	27.3°	65.2°
February	106.3	48.0	58.3
March	107.8	41.1	66.7
April	110.6	52.3	58.3
May	141.3	74.3	67.0
June	142.2	75.1	57.1
July	146.5	85.2	61.3
August	143.7	81.5	62.2
September	132.3	72.0	60.3
October	119.5	64.2	55.3
November	100.0	41.3	58.7
December	100.2	45.5	54.7

In an article published some years ago by Professor Edward Franklin, F.R.S., he laid great stress upon this element of solar radiation as being valuable to the high altitude resorts of the Engadine. He called attention to the fact that "even with a much lower thermometer the air, if still, feels warmer at an elevated station than in lower and denser regions of the atmosphere;" and that further, "the sun's rays are far more powerful at greater than at lower elevations, and their intensity is much more equable throughout the day." Experience shows that in midwinter, during the hours of sunshine, we can sit with open doors and windows, and it is a common thing for the invalid to plan picnics and excursions without regard to the cold, all due to this element of solar radiation. I remember distinctly having vaccinated a man, who sat in his shirt-sleeves out of doors to allow the vaccination to dry, in one of our days in January.

TABLE VI.—MEAN SOLAR RADIATION.

Maloja.	Fahr.	Denver, 1 P.M.	Fahr.
November, 1883	113°	November, 1886	106°
December, "	89	December, "	106
January, 1884	105	January, 1887	92
February "	108	February, "	106
Average	103.75°	Average	99 7°

For the sake of comparison I introduce the mean solar radiation of Denver, as compared with that of the Maloja, for four

months, which contrast is not unfavorable for Denver. It is probable that in the Maloja the solar radiation was somewhat increased by the reflected rays from the sun.

Table VII.—Cloudy Days, Winter, 1884–85.

Months.	Denver time.			
	9.08 A.M.	1.08 P.M.	5.08 P.M.	All day, 9 A.M.–5 P.M.
September	2	0	3	0
October	7	2	5	1
November	3	4	6	1
December	11	9	9	1
January	5	5	3	1
February	9	9	5	1
March	4	5	7	3
April	12	5	6	3

Sunshine. In dwelling on these points it would be of great interest to investigate more closely with reference to the cloudy days and hours of sunshine. The tables on this point are quite full. (See Table III.) In the year 1892 we see that there were fifty-nine days that were totally cloudy, which is somewhat in excess of the average obtained by a previous table. Glancing through the table it is seen that this is in excess of what existed in El Paso and Santa Fé, but that it is greatly under San Diego, San Antonio, Los Angeles, Jacksonville, Augusta, and Tucson, and still more decidedly under Washington, Philadelphia, New York, Chicago, and Boston, maintaining in this particular the reputation of Denver as a resort characterized by an open sky. It will be of interest, however, to study the question still more closely, and the table (VII.) for the winters of 1884 and 1885 will show the number of days in the month that were cloudy (in the interpretation of the Signal Service) at each one of the three observations, 9, 1, and 5 o'clock, and the number of days that were cloudy all day long at each one of these three observations, which shows that in the eight months under consideration, from September to April inclusive, there are only eleven days that were completely clouded—that is, eleven days out of two hundred and

forty-two that were cloudy all day long, which is certainly a very great showing in favor of a possibility to an out-of-door life.

I wish to introduce now another table (VIII.) to illustrate the absolute number of hours of sunshine in Denver and other stations in the United States for the twelve months of the year 1892.

TABLE VIII.—DURATION OF SUNSHINE (HOURS AND TENTHS), 1892.

Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October	November.	December.	Average.
Denver	5.9	6.0	6.6	8.8	6.0	11.1	8.7	9.4	9.6	7.0	6.7	6.4	7.8
Philadelphia	3.6	3.5	5.5	5.8	6.6	8.2	[2]...	8.2	8.4	7.1	4.2	4.0	5.9
Portland, Ore.	1.4	2.5	4.0	3.5	7.3	7.3	8.5	[1]8.7	4.7	[2]...	[2]...	[3]1.4	4.9
Salt Lake City	2.8	4.0	5.6	4.5	8.0	11.0	12.4	11.1	10.8	7.0	5.5	3.2	7.2
San Diego	5.9	4.6	7.1	9.2	6.4	8.2	9.4	8.3	9.0	7.4	7.6	7.0	7.5
Santa Fé	[1]4.4	6.7	7.2	9.8	10.9	13.3	11.4	9.9	9.8	7.0	7.2	6.9	8.7
Tucson	...[2]	[2]...	[2]...	[2]...	[2]...	13.0	10.2	10.3	10.7	9.5	8.7	8.1	9.6
Washington	3.6	3.7	5.0	5.8	7.9	9.6	9.0	9.2	8.1	7.3	4.3	4.5	6.5

TABLE IX.—SUNRISE AND SUNSET FOR THE FIRST DAY OF JANUARY.

Stations.	Sunrise.	Sunset.
Maloja	9.35 A.M.	3.45 P.M.
Wiesen	10.35 "	3.45 "
Pontresnia	8.30 "	3.10 "
St. Moritz	10.00 "	3.05 "
Davos Platz	11.03 "	3.00 "
Andermatt	10.45 "	3.15 "
Denver	7.30 "	4.37 "

TABLE X.—DURATION OF SUNSHINE (PER CT. OF POSSIBLE), 1892.

Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Average.
Denver	60	56	55	66	42	74	59	69	77	62	67	52	62
Philadelphia	37	33	47	44	46	55	[2]...	59	70	64	42	42	49
Portland, Ore.	15	24	34	26	49	47	56	[1]63	38	[2]...	[2]...	[3]16	36
Salt Lake City	30	37	47	34	55	73	83	81	86	62	56	35	57
San Diego	58	42	60	71	46	58	66	62	69	66	75	70	62
Santa Fé	[1]44	62	61	76	78	92	79	73	79	61	70	70	70
Tucson	[2]...	[2]...	[2]...	[2]...	[2]...	92	73	77	86	83	82	80	82
Washington	36	34	42	44	57	65	62	67	65	65	43	48	52

[1] For 16 days. [2] No record. [3] For 28 days.

[4] For 16 days. [5] No record. [6] For 28 days.

The observations are recorded by photographic instruments and are scientifically obtained. The table shows clearly the great excess of hours of actual sunshine in Denver over what exists in either Philadelphia or Washington, though not so great as are found in Santa Fé or Tucson. If we compare the hours of sunrise and sunset of the first days of January in Denver with those of the favored resorts of the Engadine (IX.), it will be seen that we have nearly two hours to their one of possible sunshine. Another table (X.) giving the percentages of possible hours of sunshine shows that in January, 1892, we had an average of 60 per cent. of our possible sunshine, as against 37 per cent. in Philadelphia and 36 per cent. in Washington. A somewhat similar and favorable comparison will run through the table, so that we learn that seasonally Denver's climate affords favorable opportunities for an out-of-door life as regards the dryness of the air, the small amount of precipitation, the temperature, and the number of clear days, the large amount of possible hours of sunshine, and an equally large amount of actual hours of sunshine.

TABLE XI.—SEASONAL METEOROLOGICAL DATA, 1892.

Stations.	Average daily velocity of wind.					Number of days with gales. (40 miles per hour or over.)				
	Winter.	Spring.	Summer.	Autumn.	For year.	Winter.	Spring.	Summer.	Autumn.	For year.
Augusta	127	118	67	115	108	0	0	0	1	1
Boston	295	326	252	276	288	1	6	0	1	8
Chicago	415	475	324	401	403	12	28	7	12	59
Denver	149	209	173	180	178	0	1	1	1	3
El Paso	178	278	180	163	202	2	11	1	1	15
Jacksonville	187	194	168	163	178	1	0	0	0	1
Los Angeles	82	94	84	74	84	0	0	0	0	0
New York	302	293	192	254	259	3	1	1	1	6
Olympi	77	84	62	79	77	0	0	0	0	0
Philadephia	274	259	209	233	245	4	0	0	1	5
Portland, Ore.	130	137	144	168	144	0	1	0	1	2
Salt Lake City	91	139	151	149	132	0	0	0	0	0
San Antonio	173	233	156	144	175	0	0	0	0	0
San Diego	101	127	125	101	113	0	0	0	0	0
Santa Fé	161	218	187	173	185	0	2	0	1	3
St. Paul	168	202	146	180	175	0	2	1	1	4
Tucson	154	190	185	190	180	0	1	5	1	7
Washington	182	194	127	156	166	0	3	0	0	3

Seasonal Winds. The question of winds remains staring us in the face. Examining with reference to seasons, we find the same relative small daily velocity of wind as we found to exist by a previous table. While this might be granted, we are constantly being reminded of our occasional high winds and dust storms, so that this really demands a closer attention. If by high winds is meant a gale in which the wind blows forty miles an hour or more, we see that in the year 1892 we had only three such winds in Denver, as against fifteen in El Paso, three in Santa Fé, and seven in Tucson; and as against three in Washington, five in Philadelphia, six in New York, eight in Boston, and fifty-nine in Chicago, which fact would possibly astonish our critics. If, however, we take a wind of much less velocity, to quote from a previous article, we learn that even in Denver the days in which there was a wind of eighteen miles or over for two consecutive observations of the three, 9, 1, and 5 p.m., in 1886, were as follows (XII.), and that there were in addition about an equal number of days when there was a wind of eighteen miles or over at only one of the three observations, a showing that is very favorable to the Colorado climate; so that we learn from this table that while the average daily velocity is small, there is also a very favorable showing with reference to the number of days to which we are subjected to a wind of any great velocity.

Table XII.—Denver, Col., High Winds (18 Miles per Hour or over), 1884.

January	1	July	0
February	5	August	1
March	1	September	1
April	1	October	3
May	2	November	6
June	0	December	2

A statistical report must, perforce, be somewhat prolix and dry; I feel, therefore, that I should beg your indulgence for having detained you with a consideration of figures; but I cannot but hope that the tables introduced may be of service

to the members of this Association in assisting them to a knowledge, not only of the climate of Denver, but of the other centres and other resorts throughout the country.

DISCUSSION.

Hon. Mark W. Harrington: One word apropos of the paper. If Dr. Fisk had consulted me personally concerning his paper, I could have aided him with much material; much which he has collected is already printed in our Bureau. I should like to invite this Association to make as complete an inspection as possible of the data we have. I should like to suggest that the Association visit the Weather Bureau, either collectively or individually. I would also suggest that in the preparation of such papers the records of the Bureau are always at the service of the members.

As to velocity. The Weather Bureau mechanism for registering velocity is one of the most perfect of its kind. But the wind is very variable in small spaces. It is impossible in placing these instruments to prevent in every case some shelter of some sort, and it is not always safe, therefore, in comparing velocities, to conclude that they represent the actual differences in wind. Take Chicago, which is given credit in 1892 for great wind velocity. The anemometer in Chicago is 274 feet above the sidewalk. In making the calculations in signals of dangerous winds we always have to make a deduction in the case of the wind velocities we get from Chicago. That may explain some discrepancies. It is unfortunate that this is true, that these observations cannot always be compared without making proper deductions for shelter, elevation, etc.; but it is a misfortune we cannot prevent. We have always to take such matters into consideration.

Dr. Babcock: I should like to ask Professor Harrington whether the high buildings in Chicago do not exert an influence upon the velocity of the winds in the streets? Does not the wind suck down some of those narrow streets?

Hon. Mark W. Harrington: I think that is very likely to be the case. It is a question of eddies, which is a very complicated question. They act in such a way as sometimes to increase, sometimes to decrease the velocity.

Dr. Griffith: It is true that I have had some experience in Colorado Springs, having visited there for months at a time; and I must say that in my opinion it is not a place to go to in order to escape from the wind. I think I have never seen any place in which

the wind had a greater sweep or carried more dust. I know residents of the city who have had their window panes reduced almost to the condition of ground-glass as a result of the action of the fine sand driven against them by the wind. At the same time, I know of no place which is better for phthisical patients than Colorado, which seems to prove that the dust does no real harm. The wind is uncomfortable, the dust most unpleasant; but that is all. A phthisical lady, a resident of Colorado Springs, once said to me that it seemed strange that it should do good to swallow dust by the tablespoonful, but that somehow this really seemed to be the case. Her health has certainly improved greatly there, for she was steadily failing in the East. This is not, of course, as a result of dust, but in spite of it. I have come across patients who do not mind the dust of these high altitudes, but who do suffer from the dampness of Eastern localities. It is this element of dampness, so common here, which seems to me to be one of the greatest elements of danger in many cases.

Dr. Hinsdale: One point might be mentioned in reference to wind velocity, and that is what the wind carries. Dr. Fisk speaks of the small velocity of the wind in Colorado; but that wind carries with it a good deal of dust, especially alkali dust; therefore it is that in Colorado we have to seek those places where dust is not so readily found; not therefore the large cities, but preferably some sheltered place in the mountains. In New York, Boston, Philadelphia, Block Island, on the seaboard generally, the velocity is very high, but on the seashore that wind carries with it practically no dust. It is a sea wind. It carries with it, no doubt, a good deal of moisture, but still it does not carry quite so much that is irritating to the bronchial tubes, the throat, the larynx, which I think is the test of how much damage a wind might do at any health resort for phthisis.

Dr. Walker: I congratulate the Committee on Health Resorts on having so early heard from Dr. Fisk. This committee was appointed only last year. Our previous committees have not been heard from, although some of them were appointed years ago. I am glad to see such early fruit borne of Dr. Platt's measure.

Dr. Fisk: The only criticism is in reference to the dust. We have a soil that is little shaded, exposed to high solar radiation, and of a porous nature. A slight wind takes up this soil and makes the dust noticeable. This is more especially true in Denver, where we have paved streets and where the city government has been somewhat lax in keeping the streets properly cleaned. I am not claiming that Denver is a health resort; there are other parts of Colorado much more desirable.

SENSIBLE TEMPERATURES.

By MARK W. HARRINGTON,
WASHINGTON, D. C.

By "sensible" temperature is meant that which is felt at the surface of the skin, especially where the skin is exposed, as on the face and hands. This may be a very different temperature from that of direct isolation or from that of shade—the two temperatures most discussed by meteorologists. On sensible temperatures depends our sense of comfort in hot weather. They are therefore of importance to every one, but of especial importance to invalids and to their medical advisers.

The sensible temperatures depend on evaporation, and when evaporation takes place they are invariably lower than the shade temperatures given in meteorological tables.

To change a definite quantity of water from the liquid to the vapor state requires the utilization of a definite quantity of that form of energy which we call heat. On evaporization this heat changes to other forms of energy; it is no longer sensible, and a feeling of coolness results from its change. Thus is caused a reduction of temperature at the spot where the evaporation takes place, and as long as evaporation continues the surface from which it takes place is cooler than the general air-temperature. In actual practice the temperature of evaporation is taken by means of a wet-bulb thermometer—a thermometer the bulb of which is always kept moist, and consequently has evaporation constantly taking place on its surface. The thermometer used for this purpose is kept in the shade in a box which permits free ventilation while it protects it from direct currents of air. In this paper, when not otherwise stated, by

Reduction from Temperatures in the Shade to Temperatures of Evaporation for Different Dew-Points

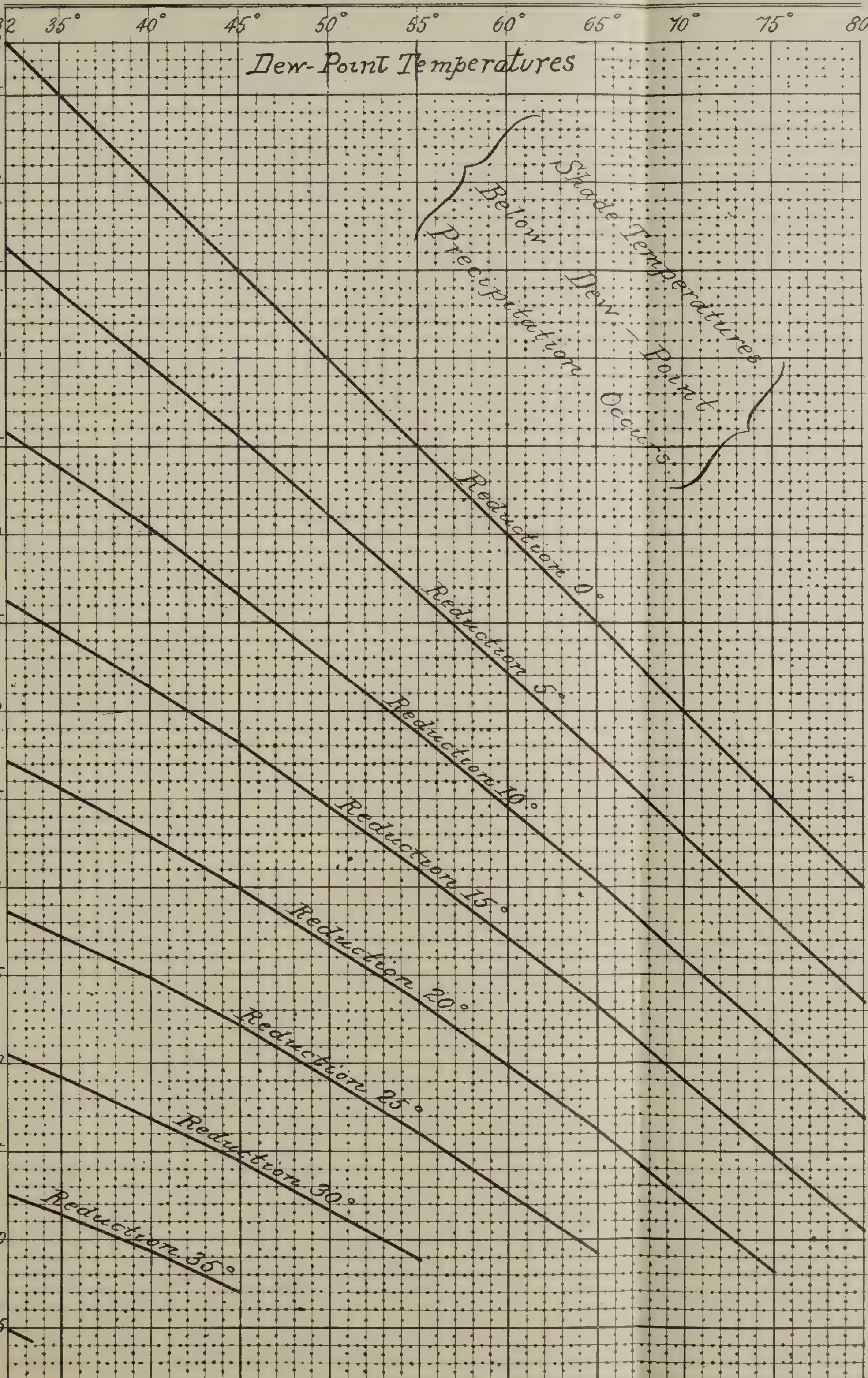


Plate No. 1.

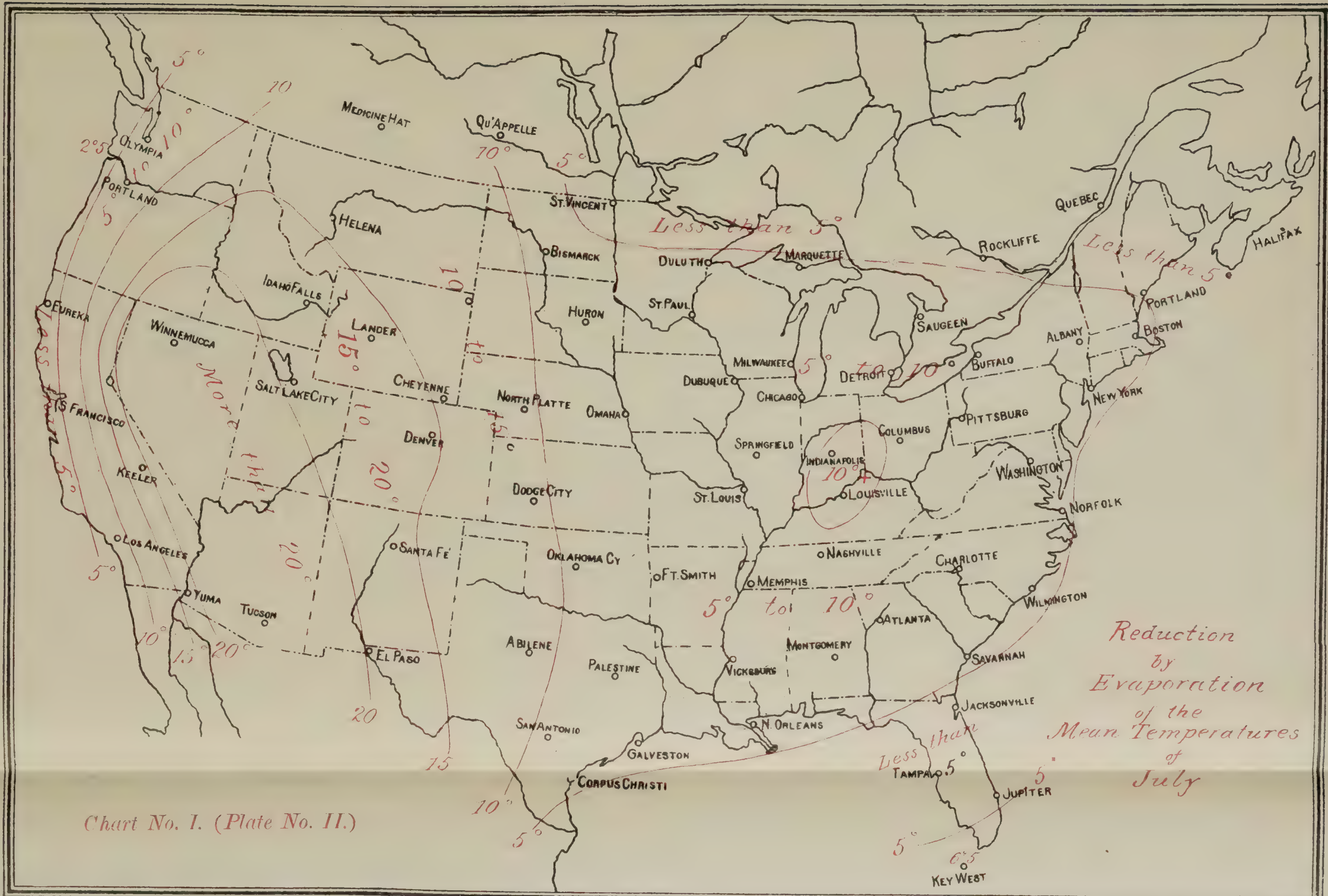
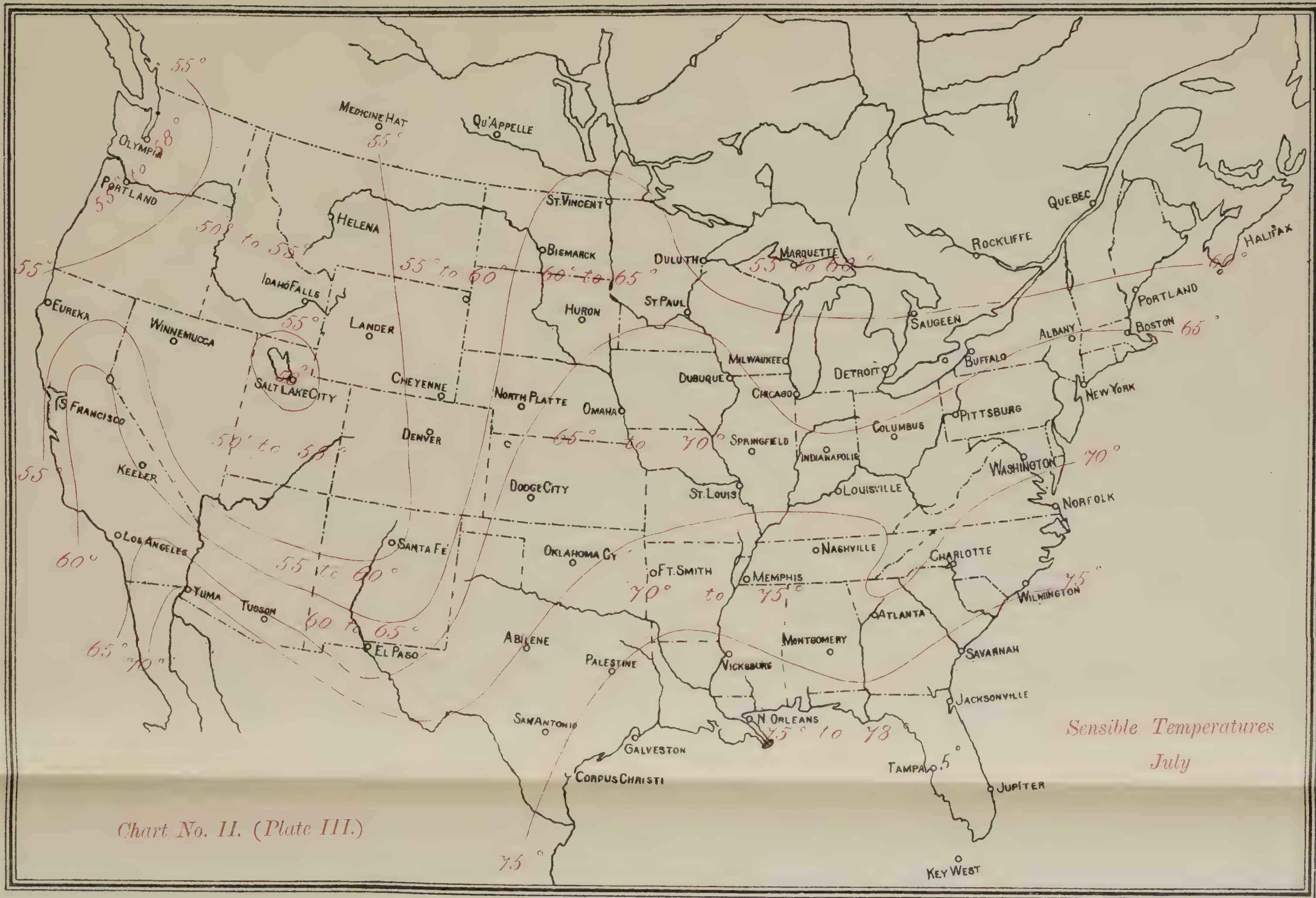


Chart No. I. (Plate No. II.)



Sensible Temperatures

July

Chart No. II. (Plate III.)

temperature of evaporation is meant that obtained by such a thermometer thus protected—that is, in the shade and protected from the wind.

The reduction of temperature caused by evaporation depends on the rapidity with which evaporation takes place, and this in turn on the amount of moisture already in the air. In general when the air is saturated with moisture (in other words, when the shade-temperature and the dew-point are the same) there is no evaporation, and the reduction is zero. When the air is supersaturated—that is, when the shade-temperature is lower than the dew-point—then condensation, the reverse of evaporation, takes place; heat is released, and, instead of a reduction, we have an addition to the temperature. But when the air is not saturated the shade-temperature is above the dew-point, and a reduction of temperature takes place, the amount of this reduction depending on the depression of the dew-point below the shade-temperature. The greater the depression of the dew-point the less the relative humidity, the drier the air, the more rapid the evaporation, and the greater the reduction of temperature caused by evaporation. The relations between shade-temperature, the dew-point, and reduction of temperature are expressed by a simple empirical equation, and are given in meteorological tables. To show them graphically and give an idea of their general character the accompanying diagram (Plate I.) has been constructed. The shade-temperatures are arranged vertically from 32° to 103°, reading downward. The dew-points are arranged horizontally from 32° to 80°, and read from left to right. Through the points where these temperatures are the same is drawn a line (here a diagonal straight line) along which the reduction is zero—that is, the sensible temperatures and shade-temperatures are here alike. Throughout the space above this line the shade-temperatures are below the dew-point; here condensation would occur and the temperatures would be raised—shade and sensible equally. Below the zero line the shade-temperatures are higher than the dew-points, and a reduction of the temperature will occur on a surface where evaporation is taking place. If it takes place

freely, the reductions will have various values, indicated by the lines drawn for each 5° of reduction. These lines are not quite straight, and they diverge toward the left. This means that with the same temperature a change in a low dew-point causes a greater change in the reduction than the same change in the dew-point when the latter is high. The chart can be used for intermediate values and can be read to the tenth of a degree in the reductions.

The amount of this reduction, or the lowering of the shade-temperature, will be greatest where the air is driest, least where the air is most moist. In Washington, Philadelphia, or San Francisco, where the moisture is usually abundant, the dew-point is generally not far below the shade-temperature, evaporation is relatively small, and hot weather *feels* hot. On the other hand, at Denver, Santa Fé, or Prescott, where the moisture is usually scanty, the dew-point is much lower than the shade-temperature, especially in hot weather, and the reduction is great—the greater the higher the temperature. The most extreme case easily accessible is that of Furnace Creek, Death Valley, California. During the observations taken there by the Weather Bureau in the summer of 1891 the maximum temperatures usually passed beyond the limits of Diagram I., and have been computed independently. On five days the maximum temperature reached 122° (June 30th to July 2d, and August 24th and 25th), but at these times the dew-point ran from 44° to 55°, and the temperatures of evaporation from 74° to 77°. The temperature felt by a person favorably situated was from 45° to 48° lower than that shown by the thermometer in the shade, and was almost cool for a summer afternoon. Again, on August 4th and 5th the dew-point sank to below freezing (30° and 27° respectively) while the maxima were 118° and 114°. In these cases the reduction was 48° and 47° and the temperatures of free evaporation 70° and 67°, or positively cool for summer.

It appears that in arid regions the reduction may make hot weather not only endurable but even agreeable and refreshing. What happens in arid or semi-arid regions periodically may

happen in other regions with a centre of high pressure—which in summer is hot and dry—or with a more enduring drought such as may occur at any season.

The observations available do not permit of a comparison hour by hour of the reduction of temperature by evaporation, because no hourly observations involving moisture are taken by the Weather Bureau. Very simple considerations, however, will show that the reduction is greatest in the hottest part of the day and least in the coldest. Similarly, the reduction is greatest in the hottest part of the year and least in the coldest.

To get some idea of the distribution of such temperatures over the United States I have selected the hottest month (July) and have used the normal temperatures and dew-points. The results are given in Charts I. and II.

Chart I. gives the reduction of mean temperatures over the United States, due to evaporation, obtained by this procedure. It appears that this reduction varies from 3.5°, at Eastport, Maine, to over 20° in the southwest. From the latter region the reduction decreases toward the east, north, and west. It is 10° to 20° over the plains and Rocky Mountains, from 5° to 10° over the Eastern States and the region about the 100th meridian, and less than 5° in the vicinity of Lake Superior and Northeastern New England. It decreases very rapidly from the arid region westward, until along the Pacific coast, from the vicinity of Puget Sound to that of Lost Angeles, it is less than 5°. It appears, therefore, from this chart (No. I.) that the beneficial effects of this reduction are most felt in that part of the country where they are most needed, and in this we have the explanation of the fact that the extremely high temperatures which are experienced in midsummer in the arid region are not particularly unpleasant to bear. I may say as a matter of personal experience, that I have frequently suffered more from heat on the Atlantic seaboard, where the temperature did not reach 100°, than I have in the arid and semi-arid region of the West, where the extreme heat of the day may reach as high as 110° or 115°. The reason of this is to be found in the greater moisture found along the Atlantic seaboard,

and the consequent less reduction from shade-temperatures to sensible temperatures. This reduction in the far West is very great; on the Atlantic seaboard it is quite small.

Chart No. II. shows the resulting sensible temperatures. It is an instructive chart, and clearly shows that the temperatures which one actually feels in the dry West and Southwest are decidedly lower than the corresponding temperatures in the Eastern States. For instance, it is a fact which appears easily on this map that the sensible temperatures at El Paso, in extreme Western Texas, are nearly identical with those at Erie, in Pennsylvania, on Lake Erie. Indeed, the sensible temperatures at El Paso in July are decidedly lower than the sensible temperatures over Iowa. The sensible temperatures over Southern New Mexico and Southern Arizona are very closely those of Pennsylvania and Southern New York and Massachusetts during the hottest season of the year. The region where we have the highest sensible temperatures in July is along the Gulf of Mexico and the Southern Atlantic Coast. Here we are likely to have an uncomfortable and oppressive feeling of heat, especially on days when the air is very moist. The region where the sensible temperature is least in the United States is west of the Continental Divide for the most part, and north of Arizona and New Mexico. It covers the States of Nevada, Idaho, Montana, a large part of Wyoming and Colorado, and the Territory of Utah, and reaches the Pacific coast in Northern California about Cape Mendocino. There is a small island of higher sensible temperatures about Great Salt Lake, the cause of which is obvious.

So far it has been only a question of temperatures in the shade. Temperatures in the sun are always higher and may be very much higher. On a hot summer afternoon a temperature of 130° in the direct sun's rays is not rare in any latitude of the United States. Sometimes this temperature reaches 140°, and occasionally it is even higher than this. The conditions for sensible temperatures already stated do not apply in such cases—in part, it may be, because of the failure of sufficient perspiration to give free evaporation, in part because of

the especial effects which strong and direct insolation has upon organic structures.

To obtain the beneficial effects of the reduction of temperature by evaporation the shade must be sought and the direct sun's rays avoided. The effects may be heightened by a natural or artificial breeze or wind, and for parts of the body covered by clothing they may be obtained by adapting the clothing to the free passage of air and moisture. For hot weather and in the shade the color of the clothing is of less consequence than its texture, together with sufficient looseness to permit of the free access of air. The reduction of temperature by evaporation may be increased by many devices for making an artificial breeze (as the fan or the punka) and by offering more water for evaporation, as by a fountain or the dripping screens used in some parts of India.

DISCUSSION.

DR. HINSDALE: This demonstration of sensible temperatures has unfolded an entirely new aspect of looking at weather maps with reference to our own personal observations. In all text-books of climate, and especially in any discussion of medical climatology, the corrections which Chart I. gives should be applied to statements that are made with reference to temperatures in any locality in just the same way that corrections are applied to all barometric readings. Only in this way can temperatures in different localities be properly compared one with another.

DR. BABCOCK: It seems to me that these facts have a practical bearing on the clothing of our patients. We are in the habit, in a perfunctory way, of advising our patients to dress in woollen underclothing the year round. But these facts with reference to sensible temperatures emphasize the necessity of our patients wearing woollen underclothing through the summer, that they may be protected from the sudden changes of temperature positively dangerous to patients suffering from pulmonary disease.

DR. WALKER: This gives a definite scientific value to data with which we have long been familiar: the question of the difference between the temperature in a moist climate and in a dry climate. This paper is a vast step in advance in the scientific study of temperature

Hon. Mark W. Harrington: I am highly gratified at the reception of this paper. The subject is new; my discussion of it is quite imperfect; I hope physicians interested in this class of subjects will find means to perfect it.

The sensible temperature is really the temperature of perspiration evaporation. Now what is the temperature of perspiration at the instant of evaporation? The more of other things water has in solution, the more heat must be used in evaporating it. The actual reduction of temperatures over a freely perspiring surface must be greater than the reduction for pure water used by me in this paper; that is a line in which the trained physician should work. It should also be remembered that actual sensible temperatures are those of the evaporation from a warm surface.

A REPORT OF THREE CASES OF BERI-BERI DUE TO DECOMPOSING FISH.

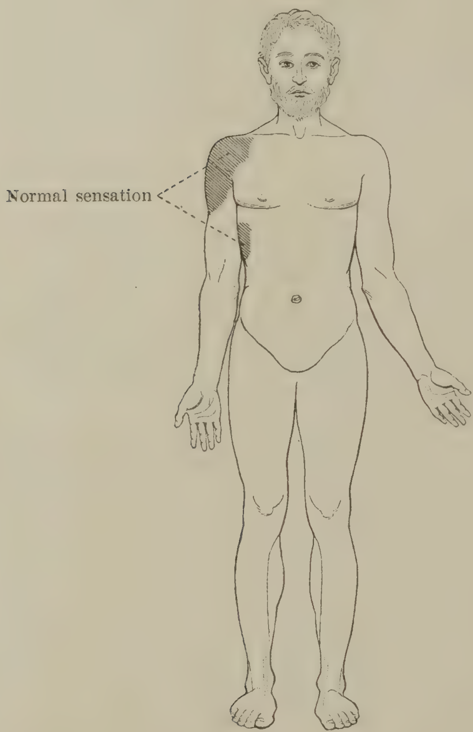
By JUDSON DALAND, M.D. (Univ. of Penna.),
PHILADELPHIA.

The first case occurred in a married man, aged forty years, a native of Port Said, Suez. He states that his wife and family are in good health. When first seen by Dr. Henry C. Boenning,[1] Quarantine Physician of the Port of Philadelphia, on November 12, 1893, he presented the following conditions: temperature normal, varying between 97.4° and 98.8° F.; his tongue was covered with small necrotic patches, and the intervening areas were very red in color, beefy, and deeply fissured. He complained of considerable pain over the præcordia, and at the apex there was a soft, mitral systolic murmur. After a few days' rest in bed a second examination showed that he was still suffering from dypsnœa, and that there was considerable cardiac palpitation. The systolic murmur is now most distinct over the third left intercostal space, and a fine diastolic murmur can be heard, especially in the fifth intercostal space to the right of the sternum. On November 16th the heart was acting regularly, and the diastolic murmur was heard, having its point of maximum density over the tricuspid region. Later these murmurs disappeared. Emaciation was rapid; there were epigastric tenderness, muscular soreness, slight œdema of the legs and splenic region. On admission to the Quarantine Hospital the lips and face were absolutely anæsthetic, and the

[1] The cases here noted were at the Lazaretto, under the care of Dr. Henry C. Boenning, to whose kindness I am indebted for the privilege of making this report.

former could be transfixed with a needle without producing the slightest pain (Fig. 1). Six days later intense hyperæsthesia developed in these regions, and the patient could not tolerate the contact of a spoon to the lips. The hands and feet were anæsthetic. The musculature was unusually developed, but

FIG. 1.



there was no loss of power. He could flex the toes, but could not extend them. His reflexes were diminished, Romberg's symptom was absent, and the urine was normal.

Sixteen days afterward I made an examination of the blood, with the following result:

The color, consistence, and coagulability of the blood

appeared normal as it exuded from the puncture. The red corpuscles were normal in size, showed no microcytes, megalocytes, nor poikilocytes. The Thoma-Zeiss hæmocytometer was employed in counting the red blood-cells, which numbered 4,750,000, or 95 per cent., and Fleischl's hæmometer gave 65 per cent. hæmoglobin. There was a moderate grade of leucocytosis, and the white corpuscles numbered about 30,000 per cubic millimetre. Many were remarkable for their gigantic size, and contained large coarse granules, not unlike the eosinophile cells that are found in such numbers in the blood of leukæmia. Blood plaques were present in moderate numbers. Careful search was made for the plasmodium of malaria, filaria, and micro-organisms, but none was discovered. As the corpuscular value of this blood was 95 per cent. and the hæmoglobin value but 65 per cent., each corpuscle contained two-thirds the normal quantity of hæmoglobin. At this date there was again an alteration in his cutaneous sensibility. There was complete anæsthesia of the nasal and aural mucous membranes, as well as of the entire skin, with the exception of the deltoid regions, following more or less closely the origin of this muscle, and the left inferior axillary region, where there was an area of normal sensation covering five by two and one-half inches. The knee-jerk was slightly exaggerated, and careful examination of the viscera gave negative results.

The second case was a man aged twenty-one years. He was admitted to the Lazaretto on November 11th, and the following is the result of Dr. Boenning's examination at that time:

Decidedly weak, legs very œdematous, intense dyspnœa, and presented a double cardiac murmur, irregular heart, pulsating jugulars, throbbing carotids, extensive nerve disturbances, and diarrhœa. Two days after admission this man exhibited a sudden serous effusion into the tunica vaginalis. He also became anasarcous and very short of breath. A physical examination showed pulmonary œdema, a marked enlargement of the cardiac dulness, irregular ventricular action, a strong but low-pitched mitral murmur, a very well marked tricuspid murmur, a well-defined thrill over the præcordia, and pulsation

of the external jugulars. His neck was somewhat œdematous. He had a cough, and occasionally expectorated frothy mucus slightly tinged with blood. In this case there was irregularity in the time of the contraction of the auricles and ventricles. The nerve disturbance was marked. There was anæsthesia of the upper lip; the lower lip was hyperæsthetic. The right upper extremity presented small areas of anæsthesia; the skin over the entire left upper extremity was devoid of sensation. There was an entire loss of the tactile sense. The abdomen was hyperæsthetic. The skin along the inner side of the thighs and anterior and outer side of the legs was anæsthetic, but a very deep puncture (half an inch) was felt. There was an entire loss of reflexes, including the cutaneous of the sole and palm.

On November 27th I examined the blood, and found that, as it exuded from the incision, it seemed rather more fluid and paler than normal. Its coagulability was unchanged, but the red corpuscles were of great variety as regards size. A few were larger than normal, and many were only half the diameter of a normal red cell.

There were a moderate number of microcytes, but there was no tendency to poikilocytosis. The Thoma-Zeiss hæmocytometer showed that there were 4,400,000 red corpuscles per cubic millimetre, or 88 per cent., and a careful count of the microcytes showed that there were 400,000 per cubic millimetre. In counting the microcytes, all red cells having a diameter of one-half, or less than the normal diameter for red blood-corpuscles, were counted as microcytes.

Many of these were mere round points, but their true character was made clear by the color given them by the hæmoglobin present.

There was a moderate grade of leucocytosis, the white corpuscles numbering about 40,000. They, too, varied in shape, some being as small as microcytes, and many of them were coarsely granular, resembling eosinophile cells. As the corpuscular value of this blood was 88 per cent., and the hæmoglobin value but 60 per cent., each cell contained but three-

fourths of the normal quantity of hæmoglobin; but as 400,000 of these red globules in each cubic millimetre were microcytes, it is plainly evident that each blood cell contained approximately its normal quantity of hæmoglobin. As many of these microcytes were mere round points in size, it is evident that the oxidizing power of the blood was considerably reduced, and it is safe to assume that there was an actual loss of 40 per cent. of hæmoglobin.

Search was made for the plasmodium of malaria, filaria, and micro-organisms, but none were discovered. His sensory symptoms were as follows: The numbness of which he complained originally had entirely disappeared. There was complete anæsthesia of the nasal and buccal mucous membranes, the palms of the hands and soles of the feet and the entire skin surface, with the exception of an area three and one-half inches wide in the infra-axillary region, extending from the anterior axillary line to the vertebral column. There was no knee-jerk, and the cremasteric and abdominal reflexes were absent; the pupillary reflex was normal. Respirations were twenty per minute, and the lungs were normal. The apex-beat of the heart was diffused, occupying an area of at least two and one-half inches in diameter around the normal apex region, and is plainly felt in the fifth interspace a trifle within the nipple line.

The impulse was more forcible than normal, was regular, and there was no thrill. The area of cardiac dulness was not increased. The first sound of the heart was heavy and muscular, like that of simple hypertrophy, and was accompanied by a moderately long, rather harsh, blowing systolic murmur, which was transmitted into the axilla, and was also carried over to the right border of the sternum on a level with the fifth interspace. At the pulmonary cartilage there was a harsh, grating, rubbing, crumbling sound, and associated with this a loud, blowing murmur unaccompanied by a thrill.

At the aortic cartilage a systolic murmur was heard, which was transmitted to the right sterno-clavicular articulation, but could not be detected in the right carotid. From these physical

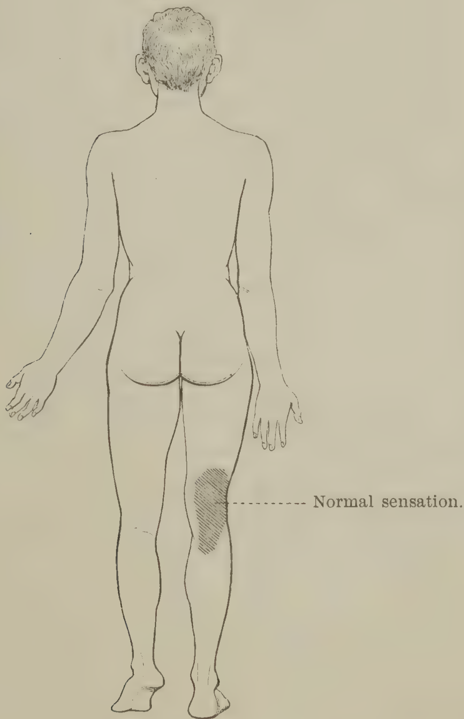
signs it was evident that there was left ventricular hypertrophy with moderate dilatation, associated with mitral regurgitation. As the jugular veins pulsated slightly, and the mitral murmur was transmitted so far to the right, it is probable that there was also tricuspid regurgitation. The murmur at the base of the heart was probably hæmic. There was a slight enlargement of the area of dulness of the liver and spleen, but they could not be felt below the edge of the ribs. There was slight congestion of the kidneys, but the other organs were normal. The legs and thighs were moderately œdematous, and the scrotum, which had been decidedly enlarged, was then no larger than a moderate-sized pear.

The third case occurred in a man aged twenty-seven years; married; a native of Zanzibar, South Africa. His wife and family were healthy. He lived in Bombay for three months prior to going on board ship. He was admitted to the Lazaretto on November 11th, and at that time Dr. Boenning found him in the following condition:

He had had difficulty in walking since the middle of September, was weak and emaciated, and had had chills and fever. His legs were slightly œdematous, and there was a distinct diastolic murmur, soft in character, and best heard over the ensiform cartilage. His spleen was considerably and the liver moderately enlarged. His urine contained a trace of albumin. There were much abdominal tenderness, nausea, and some vomiting. On the morning of November 13th he had a pronounced chill, which was repeated on November 15th. At the appearance of the first chill the free administration of quinine was begun, the effect of which, however, did not become plainly manifested until November 15th or 16th. This man exhibited in his blood the hæmatozoon of malaria, and also profound changes in the corpuscular elements. His nerve disturbances have been marked. He presented areas of anæsthesia over the extremities, abdomen, and pectoral regions, interspersed with areas of hyperæsthesia (Fig. 2). Nor did these remain constant, for the areas of insensibility became, after the lapse of twenty-four to thirty-six hours, hyper-

æsthetic. Repeated tests with the galvanic current showed the reaction of degeneration in the affected muscles.

FIG. 2.



On admission his temperature was 101.6° F.; then descended to 98° F. the next morning; then rose to 104.8° F., descending the following morning to 97.4° F., where it remained from the 13th to the 15th, when again there was a rise to 104° F. On the 16th it descended to 102° F., and rose in the evening to 102.6° F., descending the following morning to 99° F., after which time it remained normal.

An examination of the blood on November 27th showed it

to be normal in color, consistence, and coagulability. Microscopically the red blood-cells were normal in size and shape, with the exception of a few microcytes and an occasional megalocyte. To the naked eye the red blood-cells appeared normal in color, though Fleischl's hæmometer showed but 60 per cent. of hæmoglobin. The Thoma-Zeiss hæmocytometer gave 4,575,000 red corpuscles per cubic millimetre, or 91 per cent., so that each red blood-cell contained two-thirds its normal quantity of hæmoglobin. The white corpuscles were normal in size, number, and appearance. At this date the area of normal sensation extended along the right thigh in the lower third, especially in the popliteal region, and for a distance of five inches below the joint. The remaining portions of the skin were absolutely anæsthetic and analgesic, and the penetration of the needle was carried to the point of drawing blood without producing pain.

Sensibility of the mucous membrane of the mouth and hands was preserved. The knee-jerk was exaggerated, and the pupillary reflexes were normal. The thoracic and abdominal viscera were examined with negative results, with the exception of the heart, which gave the physical signs of enfeeblement.

Remarks. These men were all sailors, and shipped on board the S.S. "Lanark" at Bombay, where they had been living for three months. The crew was made up of Egyptians, Turks, Indians, Lascars, Bombayans, South Africans, Soudanese, etc. The ship was in good sanitary condition, and the voyage lasted eighty-two days, during which time they lived principally upon salt fish, of poor quality and insufficient in quantity, and occasionally partook of small quantities of rice. Each of these three men had the appearance of our negroes, both in color and in the formation of the mouth, although none had their characteristic thick lips. Their hair was short and twisted, the skin was greasy, and the perspiration possessed that peculiarly disagreeable odor so commonly observed among the black race. While in the hospital they refused to eat pork, but ate freely of everything else that was placed before them.

The greatest interest in these cases surrounds the question of etiology. Beri-beri has been observed in Japan, portions of Africa, and in the East and West Indies, and, as has been shown by Sheube and Bailz, it is an endemic peripheral multiple neuritis. Muira believed it to be due to fish, more especially decomposed fish, while others attribute it to rice, and certain it is that these cases would tend to bear out Muira's theory. It is true that these men existed for eighty-two days upon a diet that seldom falls to the lot of man, consisting as it did almost exclusively of fish and rice. The fish was of a peculiar variety, and was brought on board and prepared by the Hindoos. Some of it was dried, and much of it was spoiled. Further, the men stated that the quantity of food allotted to each was totally insufficient, more particularly when its quality was considered. All of the crew considered themselves very much superior in every way to the Egyptians, and, for that reason, they (the Egyptians) were only given to eat that which others refused. Then, too, the Egyptians would eat food killed and cooked by anyone, whereas the remainder of the crew would only eat that which was killed and cooked by one of their own nationality. The Egyptians really were the most civilized of all, two of them speaking English fairly well, and while the whole crew were on shore at the Lazaretto the Egyptians sat at a table and used knives, forks, spoons, etc., while the others ate with their hands, sitting in circles upon the ground. Each Egyptian ate about six meals per day while on shore at the Lazaretto, and when they first landed they were half-famished and excessively weak, so much so that they could scarcely stand or walk. After remaining in the hospital a few days, where they received plenty of good food and were well cared for, three of the eight were able to return to the ship before it sailed, on November 20th; one died suddenly, one eloped, and the remaining three, which are the subjects of this paper, improved so that they were able to return home on December 4th. There were several deaths during the voyage, but it is not known whether or not they were Egyptians. It is interesting to note that the other members of the crew were

practically free from disease, only one complaining of a slight swelling of the lower extremities. There was no scurvy.

The main facts, as here briefly narrated, seem to point conclusively to poisoning by some substance in the decomposed fish, probably of the nature of muscarin. In support of this view it may be stated

1. That only the Egyptians were affected.
2. That they alone partook of the decomposed fish.
3. That the other men did not manifest this disease, even though exposed to the same general conditions, because their diet was more generous in quantity, more varied, and of better quality, and
4. That the blood examination, both microscopically and bacteriologically,[1] showed no parasites.

These curious incidents partake of the nature of an experiment on a large scale, and the escape of the other men proves conclusively that the cause of this disease was not a general one, *i. e.*, not due to carbonic acid gas generated in the cargo of sugar, as has been supposed by Dr. A. S. Ashmead; not due to a specific poison or germ, as believed by Musso and Moullo, of Montevideo, and Simmons, of Yokohama, nor to rice, as believed by Takaki, of Tokio, but a chemical poison or toxine like unto muscarin.

Cases of multiple neuritis due to this cause have been reported by Dr. J. J. Putnam, occurring among the New England fishermen who frequent the Great Banks.

DISCUSSION.

Dr. Gihon: I have only to say in respect to the cases so admirably reported by Dr. Daland, that, notwithstanding his own doubts, I regard them as typical of beri-beri. I have had several opportunities of seeing this disease in the course of my naval experience, the most recent about three years ago, while in charge of the United States Naval Hospital in New York, when five cases were admitted from the

[1] The bacteriological examination was made by Dr. S. G. Dixon.

Brazilian cruiser "Guanabara," then at anchor in the port of New York. The marked symptoms on admission were the profound anæmia and the dyspnœa, the respirations ranging from twenty-four, in the mildest case, to forty-two, in the most severe. The cases resembled each other closely, differing only in severity. The pulse varied from 90 to 120; the temperature from normal to 100° F. There was diminished secretion of urine. Examination of the blood showed diminution of red corpuscles. Anæsthesia of the skin at various sites and stiffness of the lower extremities were present in all the cases, and in one there was partial paralysis. Œdema developed in one case only, being present in both legs. The cases all progressed favorably, the dyspnœa being the first symptom to disappear. Four of the cases were ready for discharge at the end of six weeks. Paraplegia in the fifth rendered his return to his own ship then undesirable, but some months later he was transferred, convalescent, to another vessel of the Brazilian fleet and subsequent letters announced his complete recovery.

There was no doubt that malnutrition was the chief factor in all these cases, who were sailors of the Brazilian Navy, and subsisted on the Brazilian naval ration, in which dried fish and rice largely enter.

The effect of the improved sanitary and dietetic provisions, which was about all the treatment required, was very gratifying. These patients belonged to the dark-skinned races, whom Dr. Daland has represented to be susceptible to this disease.

Dr. Hinsdale: Beri-beri is a neuritis, and it is infectious. There are ports well known to be infected with kakke, as it is called in Japan. Ships go into these ports and sailors become infected. Dr. Ashmead, of New York, has written much upon this subject, and attributes the cause of the disease to the prevailing custom of the inhabitants of burning a great deal of charcoal, and he believes that they become infected from the fumes of imperfect combustion. The disease is so greatly scattered through East Indian ports that this theory of its causation is hardly tenable.

Dr. Babcock: It seems to me that a certain amount of negative testimony to the claim of beri-beri belonging to the infectious diseases is to be found in the condition of the heart as reported in the cases described by Dr. Daland. We know that in certain acute specific fevers, as typhoid, diphtheria, and rheumatic fever, the heart sometimes undergoes acute dilatation. I do not refer to fatty degeneration or parenchymatous inflammation, which is the usual condition, but to simple over-distention, resulting, as pointed out by Fraentzel, from want of tonicity on the part of the cardiac muscles; so that, being unable to withstand even the normal tension within the arterial system, it yields to the peripheral resistance and stretches. Now, in these cases of beri-beri, there was acute and extreme dilatation of

the heart. The condition was not inflammatory. There was want of tonicity in the myocardium, brought about, perhaps, through disturbance in the innervation of the heart as a result of toxæmia in the course of an infectious fever. And in this respect it seems to me there is a striking analogy between these and cases of dilatation of the heart occurring in other acute affections. Dr. Daland and I are in accord in regarding these as not due to inflammation, but in addition I look upon the state of the heart as bearing indirect testimony to the infectious nature of beri-beri claimed by the speakers preceding me.

Dr. Daland: The condition of the heart in one of the cases of beri-beri was extremely interesting. Dilatation of both left and right ventricles was well marked, and the physical signs were well developed. The pathology of this condition is also interesting, as it is due to the direct action of the poison upon the pneumogastric nerve, producing a neuritis. When the inflammatory change is developed, the heart's action is slow, and, when paralysis is produced, the unantagonized sympathetic permits of bradycardia. As trophic fibres are also present, the condition of the heart muscle is in part due to this influence. The myocardium shows slight inflammatory changes, and fairly well marked fatty degeneration. Usually the right ventricle is dilated, although occasionally, as in this case, both may be affected.

With reference to Dr. Hinsdale's remarks concerning carbonic acid as a cause of beri-beri, I may say that Dr. Ashmead, in a letter of recent date, mentions than many of the Japanese in the interior burn charcoal; that he considers this produces carbonic acid, which, in its turn, is the cause of this disease. He is also of the opinion that the outbreaks of beri-beri occurring upon ships laden with sugar are due to the carbonic acid generated by the slow fermentation process which he maintains occurs under these conditions. Personally, I do not believe that carbonic acid is a cause of this disease.

Regarding the etiology of epidemic polyneuritis, I have much hesitancy in expressing any opinion, because my practical experience is entirely limited to these three cases. I have, however, gone over the existing literature very carefully, and the evidence points to a micro-organism as the essential cause of the disease. In all probability it is a micro-organism similar to the plasmodium of malaria. Although numerous observers have made careful bacteriological studies of the various secretions of the body in this disease, as well as of the blood, their evidence is so contradictory that it is clear the organisms described are not the essential causes of the disease. In addition to this form of epidemic multiple peripheral neuritis, I believe that others exist. In all those epidemics which have followed the almost exclusive use of rice, I believe that the rice was spoiled, and that these changes produced a poison capable of causing the symptoms of

beri-beri. Taylor cites that he has found an organism in dropsical effusions, in the nervous ganglia and kidney; in canal water which had been used for drinking purposes; in rice, and in the earth. When cultures from these sources were injected into animals, the symptoms of kakke were produced.

In the three cases under consideration, however, the weight of evidence unmistakably points in one direction, namely, that these men were suffering from a local and not a constitutional poison; although the entire crew were subject to the same hygienic conditions, but a restricted portion of the crew acquired the disease, and these men only were fed upon decomposing fish and a small quantity of rice, while the remainder of the crew had a more generous diet. Further, the absence of micro-organisms in the blood, even after careful examination, both microscopical and bacteriological, makes it seems quite clear that the cause of these three cases must be searched for in the food taken, and therefore I attribute it to the poison produced by decomposing fish, which poison acts not unlike muscarin, and is fully capable of exciting multiple neuritis and the other symptoms of beri-beri.

Dr. Gihon: The Brazilian sailors were all a black-skinned race. They might properly be classed among blacks, although not pure negroes.

Dr. Daland: I use the word black in the same sense as Dr. Gihon; these men were Egyptians, Indians, etc. In reply to Dr. Walker, I will say the heart returned to its normal condition *pari passu* with the increase in strength. But one patient died; but no autopsy was permitted.

Dr. Babcock: It would appear that this was simply a cardiac weakness?

Dr. Gihon: On board a man-of-war (from which I recently had my eight or ten cases) there are no cargoes of sugar; that is against the carbonic-acid theory.

Dr. Daland: I recollect clearly the result of the examination of the urine in one case, which showed no albumin nor sugar.

SOME PRACTICAL OBSERVATIONS ON SO-CALLED MALARIA BEING A WATER-BORNE DISEASE.

By W. H. DALY, M.D.,
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THE writer has for the past twenty or more years spent probably an average of two months annually in the recreative sports of the field, forest, and stream. The largest proportion of these holiday jaunts have been passed in the lowlands, or in the swamps of the lakesides, or seaside, in the pursuit of wild fowl shooting.

Many, if not most, of these regions were, and are generally, admitted to be intensely malarial in character, notably the vast Kankakee swamps in Indiana.

In former years, before the writer had noticed certain conditions and used certain precautions, he was subject to malarial disease of a continuous or recurring type, clearly traceable to his having drunk the shallow well- and swamp-water of these regions.

The observations and studies of the subject and the investigations made in the various districts from Manitoba to Louisiana, and all along the southern coast of the Atlantic Ocean and of Cuba, Yucatan, and other districts in Mexico, lead the writer to the conclusion that so-called malarial disease is not easily if at all contracted by inhaling so-called malaria or bad air of the low swampy or new lands, but it is distinctly, if not almost exclusively, due to drinking the water that has come into contact with and become infected with the malaria germ or infusoria that exists in the earth and waters of the swamp and lowlands.

This germ does not ordinarily, if at all, float in the air during the day, neither does it find easily a vehicle in the fog or vapors of the night.

Indeed it is difficult to understand how one is to avoid the night air, even if it is conceded to be deleterious—a condition I much doubt. Does any other air than night air exist at night? Is it possible to breath any other? Is there any habitation sufficiently sealed against the outside air to make the breathing of outside night air impossible?

I understand the United States Navy Department years ago made, and they may still, for aught I know, a point of advising the anchorage of war vessels in streams and waters of malarial districts so as to avoid the air currents from the swamps nearby, lest the air laden with poison should be inhaled by the officers and sailors.

I will venture to say that no air from the foulest swamp can be more deadly than the foul air that is produced by the emanations from the air-passages and from effete matter from human beings crowded into the hold of a ship. That sort of air is, indeed, malarial, while the swamp air I believe to be comparitively safe and wholesome; but of the swamp-water beware if for any other purpose than ablution.

I am fully aware that in taking the ground I here occupy I may be considered to be too radical, and that my position may be regarded as untenable. If so, I can only answer that every observing medical man must, and is bound to, tell honestly and fairly what he has gathered from his own experience, observation, and studies; and it must be considered that my observations have been prolonged, extensive, and fairly intelligent, and made, not, so to speak, second-hand, but personally and upon the ground, and in districts distinctly malarial, and that during the years that myself and others had been careful to avoid the mists and fogs of the malarial regions, as well as the outdoor night air, but all the while using the surface-, swamp-, or shallow well-waters for drinking, I as well as others of my friends suffered from malaria so-called; but later on and during the past twelve years, while abstaining from

drinking the surface- or well-water, and with the utmost freedom of exposure to the outdoor night air, fogs, rain and mists at all times, night and day, we have enjoyed complete immunity.

Whoever has shot wild fowl knows full well that the best opportunities come to a sportsman amid storm and rain, with the early mists of the morning, and when the marshes are redolent with the vapors of the evening, just at nightfall, when the wild fowl are flying to and fro, seeking their favorite haunts in the marshes to sleep.

Then there is the journey of miles homeward to the club-house, farm-house, or camp, in the small ducking boat that brings one to the fireside possibly not earlier than eight to ten o'clock at night, so that exposure is positive and close to the marsh and water as one is sitting in a small boat.

I mention the foregoing as relevant, since the profession are still the readers and learners from the classic text-books of Watson, Tanner, and Niemeyer, not to speak of many others.

Tanner says in his most attractive style: "It is worth remembering that malarial districts are most dangerous at night, and that this poison lies low;" or, as Dr. Watson says, "loves the ground." And Dr. MacCullach says: "It is a common remark in many parts of Italy that as long as laborers are in an erect position they incur little danger, but that the fever attacks those that sit or lie on the ground."

All of the older and most of the new text-books lay stress upon the strictly malarial feature of the disease, that is to say, that the poison is breathed into the system.

Some of the newer writers, it is true, give some prominence to the source of contagion, from drinking the infected land- or swamp-water, but still adhere to the belief in the medium of the air as a chief or equal source of infection.

This latter belief is a gross fallacy, in my opinion, and will not stand the test of practical proof if the factor of drinking land- and swamp-water is eliminated.

In recent years, through the digging up and renewing of the aqueducts which for centuries had supplied the city of Rome with drinking-water, it was discovered that many of her wealthy

and leading citizens had, during the period of her grandeur and decadence, actually been guilty of clandestinely draining the sewage from their country and suburban villas into the very aqueduct that supplied the city and their fellow-citizens with drinking-water.

Can there be a greater sample of public degradation, and can any evidence be stronger than this that a larger part of the Roman fever, which is unmistakably malarial, has been due to contaminated drinking-water rather than to infected air?

As I say, during these earlier years that I and others of my sportsmen friends drank freely from the running brooks and streams and from the swamps, we also endured, for the sake of the sport of shooting wild fowl, an occasional shake with the ague and many of the other disagreeable symptoms that, while they do not amount to an actual chill, one feels about as wretched as it is possible for one to feel and go about. And I and the others were all the time taking heavy doses of quinine as an antidote. In fact, no trip was ever taken to the swamp for wild fowl without plenty of quinine and a little whiskey.

But during the past twelve years, and since we have avoided drinking the surface-water, and, when it was possible, even the deeper well-water of the region, unless after boiling the same, I have been quite free, as have been others of my friends whom I have advised.

If one cannot get boiled water any other way, it is well enough to take the water that has been boiled in a brewery, viz., in form of beer.

It is now generally conceded that the malarial germ is the cause of the fever.

Lemaire, Klebs, Cardeli, and others have isolated certain forms of bacilli which they believe to be specific of malaria.

Laveran first, and Richard and Marchiafava, and Cella also found in the blood three forms of protozoa, one of which particularly produced intermittent fever by inoculation. The germ is infusorial and exists in the water and soil.

E. Maurel, in the *Semaine Médical*,[1] announced to the

[1] Annual Universal Medical Sciences, 1888.

French Association for the Advancement of Sciences that it is always easy to distinguish a healthy from a malarial soil.

The water taken from the malarious districts always contains numerous micro-organisms, some of which are possibly Laveran's corpuscles in an early stage of their development; but it is not yet certain that the germ has been isolated outside of the human body. In regard to the real value of Laveran's corpuscles in the production of malaria, he himself believes them to be indirectly concerned in the production of the infection, although their relation to it has not been absolutely demonstrated.

It is probably in accordance with Rougette[1] that the malarial microbe gives rise to symptomatic fever, by reason of its activity in producing leucomaines. During the access of fever the microbe is eliminated by the natural emunctories.

The liver is a destroyer of leucomaines;[2] but as my paper is upon the question of the manner in which the so-called malarial infection enters the human body, whether through the air-passages or the digestive tract by means of drinking-water, I, therefore, must not wander into other phases of the subject.

I am firmly convinced that further investigation will as surely lead us to the knowledge that so-called malaria is, strictly speaking, a water-borne disease, as it is that we are now being led to the right conclusion by Ernest Hart and others that cholera is also a water-borne disease, and it is our duty to educate the profession and the public, especially those who make up the population of the malarial districts, that it is the water they drink, and not the air they breathe, that decides whether they will suffer from malaria or not.

It is a great pleasure to have come into contact with many of the intelligent medical men who practise in the southern and malarial districts of our country, who are far in advance of the vague and obsolete views of many of our writers of text-books.

If there were as many such men in our profession as there ought to be, the use of quinine as an antiperiodic would soon become unnecessary.

[1] L'Union Médical. [2] Annual Universal Medical Sciences, 1888.

In fact, I regard the malarial type of fever in the United States at least as clearly preventable as any other disease that we have to deal with, and by the simple method of drinking only carefully collected and uncontaminated rain-water, which, for a simple precaution, might be boiled.

I have observed on some of the plantations of the South that among certain cattle and horses that have been shipped from the North for breeding purposes many of those that were turned out on the marshes to drink the surface-water sooner or later sickened and died with what was known as climatic fever (malarial), but the animals that were kept stabled and drank only the deep well- and cistern-water would thrive as well as they did in the North.

In the *British Medical Journal* of October 21, 1893, Oswald Baker, Surgeon of the British Army, writes that on the steamer "Scindia," which sailed from Bombay for Marseilles on August 5, 1893, there occurred several cases of acute malarial fever that were, from the account given by Mr. Baker, clearly traceable to the drinking-water, which was taken on the ship at Bombay, and not in any way due to the air that the patients breathed.

It is a pleasure to note in the medical journals—the great educators of those who write text-books—the accumulating testimony of careful observers, who agree with my observations and experience herein set forth.

In the *Medical Record* of January 28, 1893, E. D. S. writes "that five out of a family of six adults and children had suffered pretty continuously for the past six years with malaria (so diagnosticated by the best physicians), at times being quite seriously ill; with temperature 104° F.; quinine was administered. Seven months ago a Pasteur filter was introduced, and quickly every symptom of malaria disappeared. Another family had the same experience."

Dr. L. L. Von Wedekind, U. S. N., in the *Medical Record* of February 11, 1893, gives a history of some cases which indicate that to drinking the land-water on the coast of Southwestern Africa was traceable the cause of malarial fever.

The Doctor further says " that land-water is considered as a cause, and a prominently exciting cause, with naval medical officers," as is proven by the orders issued by medical officers of the different ships serving on the coast, prohibiting the use of native water for drinking purposes.

In the region about Elizabeth City, N. C., some years ago, in conversation with some well-educated medical men—among others Drs. W. J. Lumsden and Oscar McMullen—who were and are careful observers, I learned that their outbreaks of malarial fever (fresh cases) usually occurred in the early autumn, following a period of rainfall and a few subsequent warm days, but new cases only occurred among those who drank the land-water.

The inhabitants who use the storm-water, carefully stored in clean cisterns, especially above ground and uncontaminated with the soil-water, are immune from the attacks, and while the disease during the past two years has presented some varying features to these gentlemen, such as catarrhal jaundice, of an endemic character, traceable to malarial influence, as well as other forms, there does not appear to be anything to controvert the evidence that these patients took their malaria in water, either as drink or upon the leaves of the turnip top, greens, kale, spinach, cabbage, or other vegetables that grow close to the ground and have surface-water on their leaves. These vegetables are abundant and usual in the culinary supplies of the region.

One may ask why do not the New Yorkers and Philadelphians also get malaria from the same surface-water, dew, and moisture upon the leaves of these same vegetables shipped from this productive region to those cities. The answer might well be that they do, unless the leaves are well washed in uncontaminated running water before being presented for use as table food.

Dr. R. E. Boyken, of Smithfield, Isle of Wight County, Va., informed me that thirty years ago he had studied this subjcct, and had since induced as many of his patients and fellow-citizens of his county as possible to adopt the cistern-water as a beverage,

and all those families who fell in with and followed out his views are of healthy and ruddy complexion and free from malarial disease, while those who continued to drink the land-water are subject to the attacks of malarial fever.

That so-called malaria is an autocthonous disease, finding its way into the human body through the food channels, there can be little or no doubt in the mind of the original and unfettered observer.

It is true we have not found what we know to be the malarial germ and isolated it outside the human body, and we are not sure either that we have found the typhoid germ in the soil or in the suspected drinking-water; yet we are quite sure that we trace typhoid origin through these sources.

Let us eliminate the atmospheric factor in malaria by noting in each case if the soil, surface, or shallow well-water has been drank by the patient. If this has been done, the case is obviously one that has been exposed to the infection in its most potent form.

There can be no scientific question more strictly in the line and touching the true object of this learned Association than this, and it is to be hoped that in the future papers will be invited from those who have had an opportunity of observing data bearing upon this the chief phase of this unsettled question.

We do not want merely a rehash of old dogmas from the text-books, or echoes from time-worn unfounded opinions, garbled by one so-called authority from an antecedent authority, but let us have the fresh and unbiased observations and views of the thousands of intelligent medical men who have the opportunity in their own neighborhoods to make original observations and report them.

Dr. W. J. Lumsden, of Elizabeth City, North Carolina, recently wrote me that his case-books show fully 98 per cent. of patients that have suffered from malaria for the past ten years got their supply of drinking-water from the dug wells of the region.

Those inhabitants who used the water from driven wells, thirty or more feet deep, have had unmistakable improvement

in the health of their families. A driven well is made by driving an iron pipe with a perforated inlet down deep into the earth through strata of clay or marl which seals off the surface land-water. So it will be understood that the water from the driven wells is pretty securely sealed against surface-water by its small calibre and tight fit in the soil through which it penetrates.

Since writing the foregoing article I observe the growth of medical opinion is gaining strength along the lines and in the direction of the contention of this paper.

The *Journal of the American Medical Association* of May 12, 1894, contains the following:

"Dr. Richard H. Lewis, of the North Carolina State Board of Health, has prepared a circular letter for the medical men of his State regarding the influence of well-water in the production of fever and ague. He gives a homely illustration in the recited history of two families who resided as next-door neighbors in one of the eastern towns of his State. The two families each contained two adults—father and mother—and seven children. The two families were friendly, but their homes were sufficiently separated to require independent water supplies for each. One family drank from what was regarded with pride as 'the best well in town,' the other of rain-water caught in wooden tanks. The members of the first family were constantly sick with malarial disease of one kind or another. Those of the second never had even a chill.

"It is the wish to build up a line of testimony of a like character, if such can be obtained through the medical men of North Carolina. To this end he has written the appended letter, giving an invitation to a co-operative study of the well-water origin of malarial diseases:"

Dear Doctor: The evidence that malarial diseases are introduced into the system in many, if not most instances, through the medium of the drinking-water is, to my mind, conclusive. The water containing the germs, or plasmodia, is surface or superficial soil-water. Those living in malarial districts who confine themselves to water from cisterns or wells driven or bored beneath the stratum of marl or

impervious clay, in other words, beyond the water which soaks down from the surface, are to a large extent free from attacks. If the people of our eastern counties could be generally convinced of this fact, and thereby induced to act upon it, the health conditions of that really fine section would be revolutionized for the better. To bring this about is the object of the Board of Health. In order to do this facts must be presented to them in the concrete—not by illustrations from "Asia and Spasia and 'tother side 'o Hillsborough"—so to speak, but by instances among their own neighbors. I write to ask you if you know any facts bearing on this subject, and if so, that you will write them to me in detail at your earliest convenience. Give me the name and post-office of the head of the family having the experience. If not personally familiar with the facts, send me the name and address, that I may write to him direct.

THE PHYSICAL SIGNS OF SEPTIC CELLULAR ŒDEMA OF THE LUNG CONSIDERED IN THEIR RELATION TO THE PATHOLOGICAL CHANGES.

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In the year 1886 I drew the attention of the Medico-Chirurgical Society of St. Louis to a form of disease of the upper-air passages and the lung that developed a history and symptoms entirely foreign to those forms of disease known in that locality. The typical form of throat disease was a solid œdema of the mucous membrane, and the pulmonary affection showed varying degrees of consolidation or infiltration of the lungs.

In the pulmonary form of the disease the mortality was very great, far exceeding the ordinary forms of pneumonia. The symptomatic history of the disease was an unusual one, and the combination of the physical signs in the different cases was at once contradictory and perplexing, resembling, in certain cases, a croupous pneumonia; in others a bronchial pneumonia or bronchitis. Still the symptoms and the physical signs were at variance with those which are usually recognized as peculiar to these conditions.

In 1887 I began the study of the post-mortem appearances of these lungs, and published a report of the throat cases in a paper read before the American Laryngological Society in June, 1889 (*New York Medical Journal*, August 10, 1889); also one on the lung affections in March, 1890 (*American Journal of the Medical Sciences*).

In this paper I drew attention to the peculiar cell infiltration of the lungs, and claimed that this condition was the local effect

of a general septic infection of the system. As the symptoms of the disease bear a striking resemblance to the symptoms of influenza, as described by Graves, or *la grippe* of Valleix, I surmised that these might be cases of influenza. The history of 1890, 1891, and 1892, with the prevailing epidemic, proved the correctness of this view, and the cases may now be recognized simply as sporadic cases of influenza which preceded the epidemic by several years, in the same way that sporadic cases have followed it to the present time.

In 1891 Professor D. Finkler, of Bonn, published his book, "*Die Acuten Lungenentzunden als Infection Krankheiten.*" In this he fully describes what he calls an acute cellular pneumonia, and claims an essential difference between this disease and other forms of bronchial pneumonia or croupous pneumonia. He asserts that it is one of the most frequent forms of the pneumonia of influenza, and believes that it is the result largely of streptococcus toxemia. In fact, he calls it streptococcus pneumonia.

My studies of this disease have been chiefly clinical, aided by the macroscopical appearances in the dead-house and microscopic sections. The limited bacteriological study that has been made for me has shown the streptococcus to be the prevailing micro-organism.

Cellular œdema of the lung has been generally called in this country the *grippe* pneumonia. I would consider the name pneumonia as improper, as only a certain number of the cases bear a resemblance to a bronchial pneumonia, and the existence of inflammatory action is very uncertain. I would consider it to be essentially an œdema of the lung, in which the cell elements, largely leucocytes, are poured out very quickly in greater or less numbers from the lymph and bloodvessels, producing a partial or complete consolidation of the lung tissues. The fever and other symptoms which occur in the disease I believe to be strictly dependent upon the sepsis, and the symptoms and the amount of the infiltration of the lung will be determined by the intensity of the streptococcus poisoning. That this condition of the lung is only the local expression of a general sys-

temic disturbance will be seen from the changes in the other organs. In all cases there is some change in the liver. In fatal cases it is usually enlarged and softened: the spleen is pulpy, giving the appearance of a septic spleen, and the heart muscles are in some cases so softened that they can be readily torn. The kidneys are generally hyperæmic.

This conclusion is the result of a study of thirty-four cases of post-mortem made between the years 1886 and 1894. In twenty-one of these the typical appearance of the lung was alone present. In thirteen it was complicated with other conditions.

On the post-mortem table the lung in a condition of cellular œdema presents a swollen, congested appearance. It is generally brown-black in color, and interspersed over the lung are areas of a lighter brown or gray. These areas may be of limited extent, or they may include the greater part of the lobe. The boundaries are irregular and scattered over different portions of the lung. If we take up a portion which is brown-black in appearance, we will find that on pressure it crepitates with difficulty. The crepitation is apparent, but the "feel" of the lung presents a degree of solidity foreign to healthy lung tissue, and the crepitation is produced only with more pressure. When placed in water it quickly rises to the surface. The cut surface is smooth and moist. If this section of the lung is placed under the microscope, it will be seen that the alveolar walls are infiltrated with numerous cell elements, but the interior of the air-vesicles remains free. The physical signs of a lung in this condition are such that they can be fully explained by the pathological conditions. The free-flowing respiration of normal lung expansion is wanting in the respiratory sound. The lungs seem to be expanded with decided effort, and the inspiratory sound is delayed and prolonged. In quality the sound may be slightly harsher than the pure vesicular breathing. No change, or only a slight lengthening of the expiratory sound is apparent. The percussion sound may be so slightly changed as to appear normal, or there is only a slight shortening of the normal percussion resonance.

Another area of the lung presents a dark-brown color. To the hand this gives a feeling of solidity. When cut it appears as a solid substance, like a piece of beef. There are no crepitations on pressure, but when placed in water it floats on the surface. Examined under the microscope we find the alveolar walls densely infiltrated with cell elements, with a partial filling of the vesicles. Some of the vesicles are more filled than others, but in the greater part we recognize the existence of air spaces. The amount of infiltration varies in different sections and portions of the sections, but the presence of a large number of partially filled vesicles may be recognized in all. In a cut section of the bronchus the walls may be seen thickened by the same cell elements.

The physical signs produced by this condition of the lung depend largely upon the amount and extent of the infiltration of the bronchial mucous membrane, together with the partial infiltration of the vesicles. The percussion sound is always deadened, giving to the finger an increased sense of resistance. In minor degrees of infiltration through the deadened sound a slight degree of pulmonary resonance may be appreciated. When the infiltration is greater we find the percussion sound very dull; there may be even a perfect flatness. In some cases we find an exaggerated full percussion sound, such as we find in emphysema, and it may be even tympanitic in character; but even if this is the case, the sense of resistance is still always somewhat increased. It is difficult to explain this increase in the percussion sound under such conditions, and we can only believe that it is either due to the confined air in the vesicles, through the complete obstruction of the bronchi, or it may be the result of some gas-producing micro-organism, which it has been claimed has been found in these lungs. Occasionally we find an interchangeability between the dull percussion sound and the exaggerated resonance. The same place may be dull to-day, and to-morrow may be hyper-resonant, and this may again be replaced by dulness.

The auscultatory signs of this degree of cellular œdema are very perplexing and contradictory. In cases where the œdema

of the bronchial mucous membrane is sufficient to thicken the membrane, rendering it dry, we find the normal respiratory murmur changed into a harsh respiration, in which the inspiratory sound is lengthened, sharp, and of a high pitch, and immediately followed by a prolonged expiration of lower pitch. In some cases the expiratory sound is absent, and the prolonged harsh inspiration is alone heard. In cases where the œdema narrows the bronchi to a still greater degree we will hear sibilant râles. They may be inspiratory or expiratory, or both. They resemble asthmatic râles in a measure, but they are shorter in time, the inspiratory râle rarely covering the whole time of the inspiratory act; a distinct interval of silence may or may not be followed by the expiratory râle. Occasionally we will hear a large-sized subcrepitant râle. They resemble dry crackling sounds, and are probably formed by the passage of air through the viscid secretion of the bronchi. The dry and the moist râles are not, as a rule, continuous phenomena. They vary from day to day, and may entirely disappear for a time, to be again heard in varying degrees of intensity.

Where the œdema is so great that it completely occludes the bronchi we will find a complete silence over the lung. This silence is even greater than that formed over pleuritic effusion, where more or less distinct breathing may often be heard. Vocal and pectoral fremitus is wanting. This silence of the lung may continue for an hour, or for weeks. It may be broken first by a gush of mucous râles, which can be heard during the inspiration. These râles may again disappear, and no respiratory sound may be heard. Later they have a tendency to become permanent, and may continue, as large-sized inspiratory subcrepitant râles, for months. In other cases we have a gradual return to normal breathing without any appreciable râles.

The portions of the lung which are of light-brown color, or which may appear a steel-gray, give all the evidences of a consolidated lung. They are dense and firm. When cut the surface appears dry, smooth, and glistening, and when placed in water sink instantly. Under the microscope we find the

alveolar walls and the vesicles densely filled with the cell elements. The physical signs of this condition are the ordinary signs of consolidation (bronchial breathing and increased pectoral and vocal fremitus). The percussion sound is flat. Occasionally the bronchial breathing is replaced by amphoric breathing. The tendency of this consolidation is to continue for a long time. It remains after all the other portions of the lung have become normal. The disappearance of the abnormal signs and the reappearance of healthy lung action are gradual. The conditions of the lung seem to present a most fertile soil for the growth and development of the tubercle bacillus, and I believe that a large number of our present cases of acquired tuberculosis have their origin in this condition of the lung.

Occasionally we find signs of cavities. On post-mortem examination we find the cavities to be irregular in form with soft walls, giving the appearance as if they were worm-eaten, with an entire absence of the fibroid tissue, which is usually seen about tubercular cavities.

I would describe the different degrees of infiltration as types, and not as stages of the disease, for I have not found them to merge from one into the other. A type which occurs in the beginning in a certain portion of the lung continues throughout the attack. The infiltration is sudden, and resolution may occur as quickly.

Note.—The treatment of cellular œdema of the lung, which has given excellent results in the hands of the writer, may be thus summarized: Fifteen-grain doses of the benzoate of sodium, combined with half-drachm doses of the liq. ammoniæ acetatis, should be given every two hours. Twenty-five drops of the muriated tincture of iron may be given in addition every four hours. Whiskey or champagne should be given freely, and digitalis is almost always required through the whole course of the disease. Repeated counter-irritation, with either mustard or iodine, promotes the absorption of the cell infiltration.

INDEX.